Investigating clothing sector interrelationships: a study focused on industry specific technology use.

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Abstract

This study has evolved from the researcher's clothing industry experience and interest in the development of technology use. It aims to discover clothing industry interrelationships and knowledge of industry practice using sector specific technology use as the vehicle. Opinions have been obtained from across the clothing industry, taking into account perspectives from regional Micro, Small and Medium sized Enterprises (MSME), the high street retail sector, relevant government agencies and technology providers. For the purpose of this research the term clothing industry is used to describe an industry that is considered to have three main sectors: design, manufacture and market. Gaining an overview of each sector was essential to investigate industry interrelationships, processes and practices. A valid depiction of the industry was required to understand how each sector perceives both the internal and global perspectives.

As the research required opinions from a variety of industry segments, selected industry representatives were identified. The resulting approach was to structure the research into three elements. The data collection process followed a chronological order: consideration of the MSME clothing sector, which comprised of a preparatory exercise incorporating a developmental approach that included a section that collected, compiled and recorded relevant industry terminology and also a process mapping technique designed to elicit knowledge of internal practice; a questionnaire devised to understand industry technology suppliers; investigate retail sector technology usage, a preliminary questionnaire was followed by a semi structured interview; conducting three sector specific focus groups utilising refined findings from prior elements; final summative interview to discuss outcomes of the focus group sessions. This incremental knowledge building approach was devised to utilise a combination of basic quantitative findings as subject matter for further qualitative analysis within a summative interview.

This study presents an insight into the unique knowledge base existing across three industry segments within the clothing sector through analysis of terminology, process maps and topic related discussions. The findings obtained realised there are critical issues surrounding MSME businesses and technology use, therefore identifying need and opportunity for change. The main contributions of the study are: development and implementation of the incremental research strategy; the identification of issues

affecting the use of technology in the MSME sector of the clothing industry; realisation that the industry community has dissipated with the shift in industry focus; presentation of potential solutions to improve product visibility between user and provider.

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Abbreviations

ASBCI	Association of Suppliers to the British Clothing Industry
BCIA	British Clothing Industry Association
CAD	Computer Aided Design
CAM	Computer Aided Manufacture
CfDR	Centre for Design Research
CMT	Cut, Make and Trim
CRM	Customer Relations Manager
DTI	Department of Trade and Industry (government organisation)
e-Business	Electronic Business
EAI	Enterprise Application Integration
EC	European Commission
EDI	Electronic Data Interchange
EPSRC	Engineering and Physical Sciences Research Council
ERDF	European Research Development Fund
ERP	Enterprise Resource Planning
ICT	Information Communication Technology
IMS	Inventory Management System
KEA	An internal company acronym for a bespoke ERP operating system in place since the 1980's.
LCF	London College of Fashion
NE	North East (region of the UK)
ONS	Office of National Statistics
PDM	Product Data Management
PLM	Product Lifecycle Management
RFID	Radio Frequency Identification
ROI	Return on Investment
RTM	Return to Manufacturer
SDC	Society of Dyers and Colourists
WIP	Work in Progress

Acknowledgement

As with each PhD student, subject reason and method of study is different, mine was to develop a way to gain insight into the ways that small businesses within the clothing sector could utilise technologies. The clothing industry has rarely been studied at doctorate level, especially from a practitioner's point of view, therefore the scope was in place to undertake an investigation appropriate to the needs of the sector.

Having both a clothing education and industry based background, combined with a desire to investigate possibilities for change, provided me with the insight and foresight from which to consider possible opportunities for development in industry practice. The approach to data collection was devised to elicit knowledge from different areas within the industry, through the use of conventional and more developmental approaches. The uniqueness both of the subject matter and the approach is therefore transposed onto the thesis, how it is approached, conducted and completed. I hope that those that choose to read this will gain an insight into an existing industry that could be offered further opportunity to develop.

Completing this research programme has been a monumental journey for me, both on a personal and professional level. It has taught me a great deal about the importance of effective application of knowledge and effort in order to achieve desired objectives and goals. There has also been the personal sense of reward knowing that I have been able to apply the academic rigor to an industry not normally associated with scholarly undertakings.

I was fortunate to have undertaken the study with a fully funded studentship from Northumbria University. For the duration of the research programme I was based at the Centre for Design Research (CfDR) which exists within the School of Design. As I became more familiar with the realities of PhD research I became aware I was based in the School originally at the forefront of comparatively new field of Design research.

I would like to take the opportunity to thank Dr Kevin Hilton, who as my Principle Supervisor was able to apply his design practice based knowledge, and of PhD research practice to my subject area. Thankfully he was able to offer practical guidance and constant support, even at the most frantic stages! Also I would like to thank Christine Saunders, my Second Supervisor, and subject specialist, who had a

fantastic ability to identify gaps in my thinking, approach and writing, all of which was greatly appreciated.

Being based at the CfDR provided me with a ready made support network of colleagues, all of which have been so helpful. In particular, my fellow PhD researchers who have readily offered friendship, support, ideas, inspiration, basically everything needed to be successful in such a venture. Also I would like to thank those colleagues who have become much valued friends and have helped me so much.

Thanks must be given to those industry representatives across the sector who gave valuable insights into industry practice. Also to the members of staff at Skillfast-UK who were able to enhance the government perspective of this study, with special thanks to Fred Kirkland who aided both the processes of regional company identification and implementation of data collection elements.

During this study, I have not only been a student, but also a subject of research! A colleague and friend Erik Borg has undertaken a PhD study which investigates the often complex journey of researchers completing design or arts based PhD's. Throughout my time as his subject, he has offered friendly advice and guidance, as well as reassurance as to the underlying value of my endeavour.

Within such a specialist area of study, finding those with a common interest is a relatively rare occurrence. During my research I luckily met Dr Penelope Watkins, who also shares a passion for innovation within the clothing sector. Our friendship began at a crucial time within my research programme, and since then Penelope has offered me advice, a much needed sounding board, support and encouragement at times when I needed it most.

Support from those closest to you is vital when completing such a large project, even when they are not entirely sure what it is about! I would like to thank my partner Jason, who has given me the encouragement and the space I needed whilst completing this study. Also to my Mam, Dad and Nan all of who provided much appreciated light relief, as well as all the support I could ever need. Sadly due to her passing, my Nan will not see me graduate, I am so pleased she was around to know I was successful in my viva!

To you all, I just want say how grateful I am that you were there for me. Thank you.

Declaration

This work has not previously been accepted in substance for any other degree and is not being concurrently submitted in candidature for any other degree. The thesis is the result of the author's own research and investigations, except where otherwise stated. The use of other sources is acknowledged and identified with explicit references. Full list of references is appended.

Name:

Signature:

Date

Chapter 1 Introduction

1.1 Background of research project

This thesis is based on a programme of research which investigated industry specific technology use within the clothing sector. The research subject area has evolved from the researchers experience and interest in development of the clothing industry. Educated to MSc level with a predominant clothing focus, insights were gained into garment construction methods, design processes and considerations, ergonomics, anthropometrics and demographics. Clothing industry experience was gained during three years as a management trainee at a large UK based manufacturer. However changes within the industry climate resulted in a career shift. An interest in clothing sector development was ongoing, and was revisited during an assignment for an Information Technology Practice post graduate course. The project was based on development of clothing retail practice and made reference to the 2001 UK National Sizing survey. Further investigation revealed that developmental digital bodyscan technology had been utilised to undertake the study and to compile an extensive database of body measurements. The desire evolved to further investigate the subject area of technology use within the sector, building from a practical industry knowledge combined with this renewed insight into the potential of technology use for provision of clothing from UK based small businesses. This research illustrates the potential opportunities to be gained for clothing provision through the use industry specific technology, within the UK clothing industry.

The diagram shown in figure 1-1 has been incorporated to identify the essence behind the researcher's desire to conduct this research. Working within the clothing industry offered practical experiences of processes and practices, identified needs and opportunities for change within this sector. Technology use by larger organisations within this sector is prevalent, however it is often under-utilised by Micro, Small and Medium sized Enterprises (MSME), which could suggest there is little awareness of the benefits of technological engagement. During the initial stages of the research programme, much consideration was given to the focus of the research to ensure that the study identified a subject that offered most value through investigation. The decision was made to use technology usage within the sector as a vehicle by which to investigate broader aspects of industry practice. The research has devised a process

by which information can be extracted from disparate industry sectors and compiled in a way that generates the foundations for cohesive discussion.

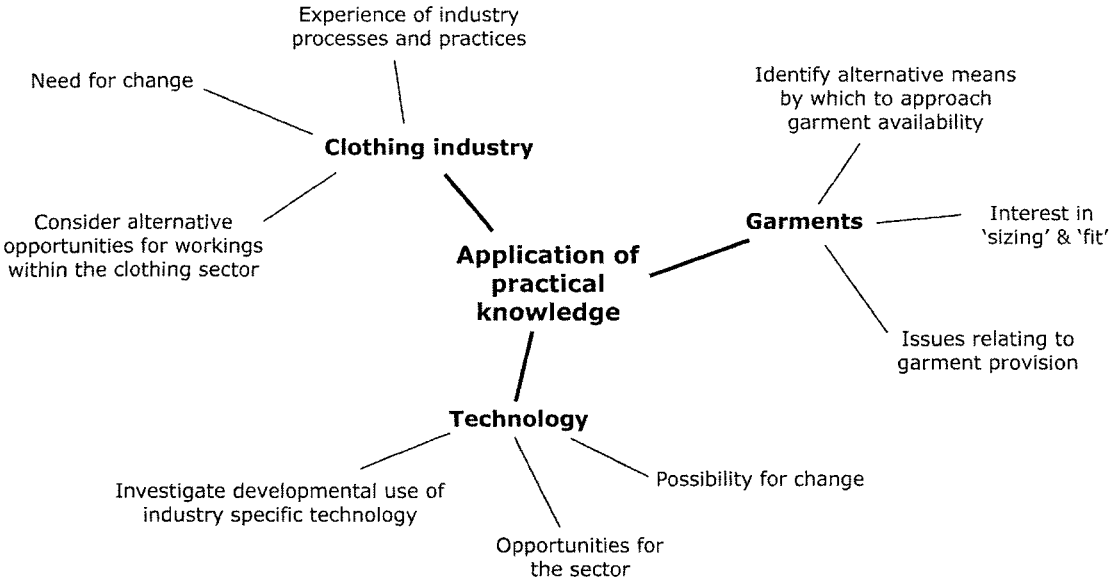


Figure 1-1 Visualisation of areas of interest

In order to effectively manage this project it has been necessary to view the research of the clothing industry from three perspectives, gaining opinion from regional MSME companies, large clothing retail sector businesses, and also the providers of the industry specific technologies. This inclusive approach was undertaken to provide an overview of the clothing industry in terms of each of the stakeholders' position, in order to contextualise the local and the global understanding of technology use. The local perspective investigates industry processes and interrelationships, whereas the global view was incorporated to provide a broader perspective from technology users and providers. Throughout, industry specific technology was used as the vehicle to gain understanding of current influences to the sector

Relative to the industry, technology has evolved to cater for the needs within the clothing manufacture and retail sectors that have occurred as a response to social, economic and market change. However, quick successions of change can result in late adoption of technology, if the development is not intuitive enough for potential end users to perceive the value and assess risk. Consideration of an alternative approach by which to supply consumer needs may lead manufacturers to enquire into new technological opportunities. However there are a number of issues that might influence the potential acquisition and application of new technologies. Companies consider

themselves to be dependent solely upon their existing skills, which are very much craft-based, and are generally perceived to be unlikely to benefit much from new technology. There is also the inherent culture, which wants everything 'yesterday', this generates an intense commercial pressure environment, which may not always prove conducive to managed change as there is the likely need of considerable time to identify and implement new technologies. Finally, there is the acknowledgement of the cultural perception of technology being costly and difficult to set up (Skillfast-UK, 2004a, pp 36) has provided a basis from which to proceed. Each of these issues must be considered by companies prior to investment.

An initial area of focus involved constructing a research programme that would investigate and identify practical means that enables MSME organisations to improve business practice and the provision of garments through the use of technology. The investigation into specialist developmental technologies identified a need to gain further understanding of currently available and already utilised technologies. This was considered appropriate because it is proposed that by increasing the use of more widely available technologies further opportunities could be realised.

To gain an accurate industry insight, a regional focus was considered appropriate, with the intent to generate a transferable model of investigation, once formulated it could then be applied within any regional situation. It was considered vital to gain an understanding of how the clothing industry develops and maintains commercial success, and to identify the level of reliance on specialist tacit knowledge deeply embedded within the sector. Much of this tacit knowledge related to the craft-based skills which had been built up through each industry's practices over many years. This knowledge was accessed through contact with individuals from a selection of representative MSME business organisations, based in the North East (NE) region of England.

The study of the clothing industry was devised to further understand the systemic processes, influences and interrelationships that exist within this diverse sector. The purpose was to gain a representative understanding of industry practice in order to identify opportunities, and inform future change. A key requirement of the research was to gain the input of practitioners from different disciplines within the industry sector. Having personal experience of a manufacturing environment, the researcher was aware of the unique people who are drawn to this industry. There are many passionate people working within the sector, individuals who are interested and excited by

opportunities to develop and change. Utilising this understanding of the types of people working within the sector inspired and informed the idea that there was a need to engage these participants in the data collection for this programme of research.

The primary research conducted in preparation for this research programme suggested that no similar studies of this type had been conducted, in any industry, in which perspectives were gathered and analysed from different industry sectors and influencers (government agencies). With no former studies on which to base the format of this research programme, the approach has been devised to compliment the industry sector components.

1.1.1 The authors understanding industry practice

The topic area of this research programme has evolved from a first hand, practical understanding of clothing industry practice. In order to contextualise the approach undertaken the following paragraphs and diagrams present the researchers' interpretation of industry processes.

Created during the initial research stages, this diagram (figure 1-2) was generated to visualise the key areas of industry practice: design; manufacture; market and technology, and the ways in which data and products flow between each. The effectiveness of this diagram as a tool to illustrate personal understanding brought about the realisation that it offered a means by which to effectively elicit practitioners' specialist process knowledge in a repeatable and comparable form. This was then utilised by developing a process mapping exercise to be incorporated as one of the key data collection areas. The resulting maps were compiled and analysed at a later stage of the research and formed the basis for discussion within a focus group environment.

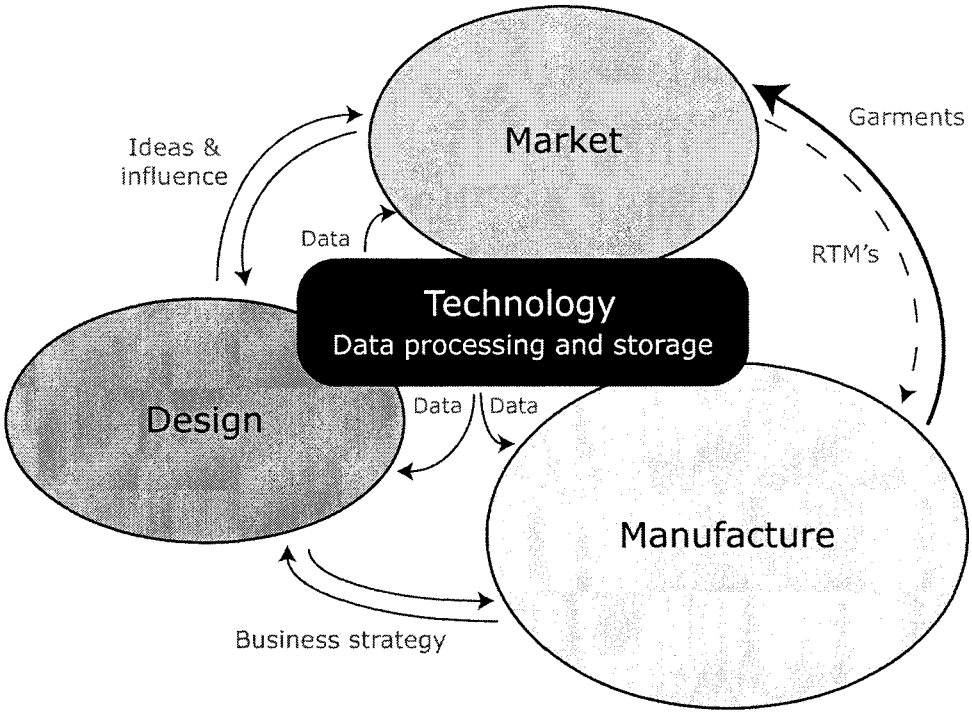


Figure 1-2 Conceptual map of industry process

The principal focus of the research subject was to consider clothing industry practice. The diagram shown below in figure 1-3 was created to provide a detailed illustration of the way in which the processes associated with design generation and manufacturing practicalities interrelate. It shows that design does not exist within a vacuum, and that there are important roles and functions such as garment technology and product development which work between the disciplines to ensure garments are produced to design and production specifications.

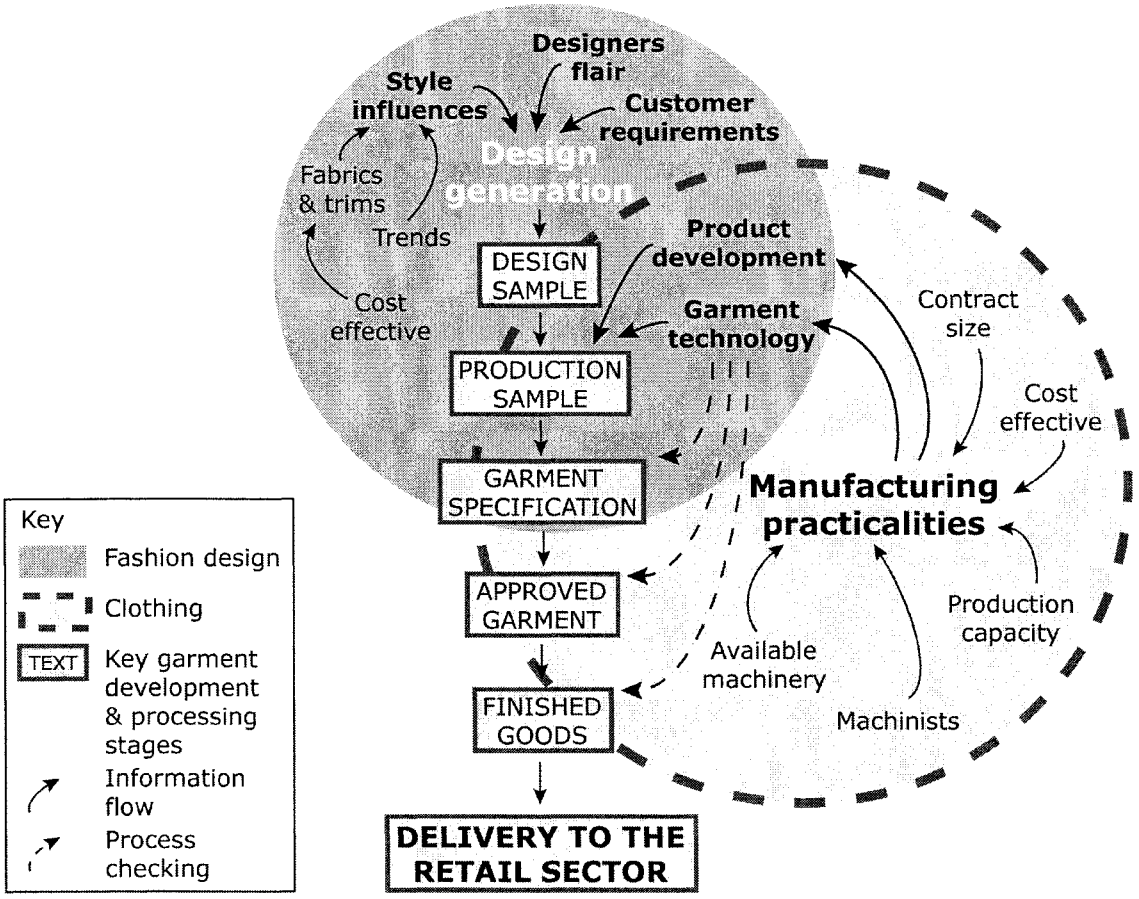


Figure 1-3 Interrelationships between fashion/design and clothing manufacture

These diagrams will be discussed further within the methodology chapter, section 3.1.3, as their conception influenced elements of the data collection and analysis process.

1.2 Research intentions/approach

This research required a broad and systemic understanding of the industry in order to fully consider the diverse areas of the clothing sector, taking into account business practice and working principles across organisations. By obtaining and assimilating diverse perspectives from the industry sectors, the research sought to classify the structure and configuration of processes occurring within the sector through the identification of the interrelationships between roles.

The intention of this research was, from the limited data available, to generate and build theories rather than identify and test existing theories, this is referred to as a grounded theory approach. Clear identification of the research focus has allowed the subject to be appropriately contextualised. The content of the research question

section has been compiled to outline the breadth of the subject area that was investigated within this PhD research programme. It illustrates how a global and local view of technology application within the clothing industry was utilised within the research ensuring all clothing industry technology to be considered.

1.2.1 Research question

The research question was created to underpin each aspect of the programme of research, and therefore forms the basis of the approach and the findings;

Research Question: By what means does the clothing industry keep abreast of technological developments, acquire, apply and evaluate the success of new technologies?

1.2.2 Aims & objectives

The aims and objectives of this research programme were devised to generate new knowledge directly related to application and use of newly available technologies within the areas of clothing manufacture and fashion design. As the focus of the research subject was revised following the Mid Point Progression, the aims and objectives had to adjust accordingly. They changed to improve the potential of the outputs and outcomes, while still retaining to the original intention of the research. Below each of the three aims are described followed by the objectives devised to achieve the intended aim;

Aim 1: Generate a contextual understanding of clothing industry processes and practices to identify:

- Identify suitable cross sector business types, representative of the current industry climate and categorise industry sectors to demonstrate and acknowledge their priorities in approach to business
- Illustrate how industry specific technologies as a priority of practice are utilised
- Propose how both sectors and roles within sectors interrelate

Aim 2: Develop a fit for purpose research methodology and analysis tools appropriate to different roles across the different sector disciplines

- Assess research methods to identify suitable modes of data collection
- Consider each research element to devise appropriate means by which to elicit knowledge within this competitive environment
- Evaluate the research methodology

Aim 3: Generate theoretical frameworks to reveal issues that could affect future development of the clothing sector

- Formulate a framework to engender non-competitive communication to enhance collaborative industry practice
- Analyse the cross sector findings using the grounded theory approach
- Recognise themes revealed within the research findings
- Give examples of areas that could influence clothing industry practice

1.3 Relevant definitions

There are a number of key terms that are used throughout this thesis, they have been defined below to clarify how they have been applied;

Clothing (Industry) – a term used to describe wearable garments. Within this programme of research it is used as a term to describe the industry that creates garments to be sold within the retail market. In the context of this research it incorporates design, manufacture and retail.

Interchangeable use of the word clothing – the terms garment, apparel and fashion have similar yet subtly different meaning within the sector, yet have been used by some as meaning the same and therefore interchangeable.

Industry specific technology – this is a term that has been used throughout the thesis to refer to technologies that have been devised for use within the clothing sector. Further details of the functions of the technologies are outlined within section 2.3, also additional company information can be found in appendix 15.

Table 1-1 Outlining types of industry specific technology

Technology	Examples of applications		Examples of suppliers
	Hardware	Software	(included in this study)
Design & product development	Digitizers Embroidery	PDM & PLM to aid planning and costing	Lectra GERBER TECHNOLOGY Expect More.
Manufacture	Cutting Spreading Sewing machines	EDI Vendor managed inventory Supply-chain management	BLACKMAN & WHITE
Sourcing, logistics & transport	Logistics tracking RFID	Production planning Supplier relationships management	HUMAN SOLUTIONS ...Focusing on the human being
Retail	POS capture	Computer based stock control Visual merchandising tools	visualretailing
Developmental	Digital body scanning	For bespoke and mass customised garments	alvaproducts

Grounded theory – (def) an approach which emphasises the systematic discovery of theory from data, so that theories remain grounded in observation of the social world, rather than being generated in abstract (Robson, 2002). Within the context of this research, grounded theory methods have been adopted to offer rationalised analysis of the findings, to ensure they were representative of the clothing sector.

Interrelationships - derives from the verb interrelate, which is to be in or be brought into a mutually dependent or reciprocal agreement (Robinson & Davidson, 1996). This term is represented by the links illustrated within the process diagram element of the data collection.

MSME – a term used to describe businesses that have less than 250 employees, it can refer to businesses of different sizes: Micro 0-10, Small 10-50, Medium 50-250.

Sector – this term is used in two contexts throughout the thesis, as an accompaniment or alternative to industry (clothing industry/sector), and in reference to the elements within the industry (design, manufacture and market sectors).

These terms above have been used throughout the thesis. A more extensive terminology can be found within the glossary, and any abbreviations are outlined prior to the main text (pp xii).

1.4 Overview of research methodologies

This study uses a developmental hybrid methodological approach (Robson, 2002) that incorporates multiple techniques to acquire data, the findings of which will be both quantitative and qualitative. Using an approach akin to that of anthropologists (Simpson & Humphrey, 2007), where quantitative methods were utilised to form the basis of discursive techniques in which qualitative data was obtained. This approach enabled an interdisciplinary study to be conducted that compiled data to be analysed and discussed.

The developmental component is a form of knowledge elicitation (McNeese *et al.*, 1995) where an exercise was devised using a heuristic approach (in order to find the appropriate solution). Its purpose was to elicit industry practitioners tacit process knowledge (Gertler, 2003) from MSME industry practitioners. The additional data collection components comprised of questionnaires, interviews and a series of focus

group sessions, all compiling related data to further contextualise the research findings. This approach incorporated an incremental knowledge building technique which ensured relevant findings from each phase could be incorporated into subsequent stages.

Within this research programme the MSME organisations were considered as the principle focus, however gaining insight into additional sectors served to build a more accurate picture of the current industry. It was therefore considered appropriate to obtain perceptions from significant businesses within the high street retail sector, as well as a representative cross-section of the regional clothing industry. This approach sought to generate dual element results, both within a national and regional context. The region selected was the NE due to the convenient proximity of the sample group, but more importantly that the businesses were reputable and recognisable and considered to be prospective users of new technology. The consideration of the industry within this context generated an insight into the workings of a unique geographical region, in order that the research systemically encompasses all areas of the clothing industry which could benefit through the utilisation of new technologies.

To illustrate the approach to data collection, the researcher devised the visual model below (figure 1-2) to illustrate the different stages of the research. It shows the sequence of the research extraction, consolidation and the cohesion, within each relevant indicator the elements (E) and phases (P) are illustrated.

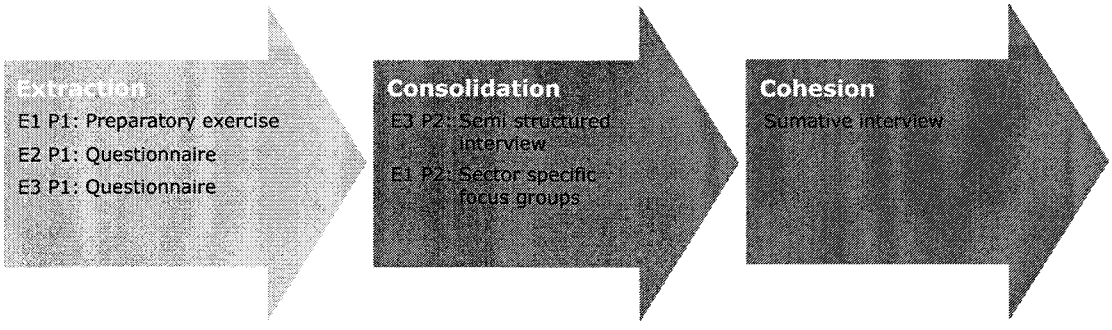


Figure 1-4 Data collection – extraction, consolidation and cohesion

Each of the research components that are illustrated in figure 1-2 are grouped within the following research elements that are listed below. These elements and phases were implemented in the order shown above.

E1 Regional MSME sector analysis;

E1 P1 – is a preparatory exercise

E1 P2 – three homogenous focus group sessions

E2 to understand national and international industry technology suppliers;

E2 P1 – a short questionnaire

E3 analyse IT usage within the high street retail sector

E3 P1 – preparatory questionnaire

E3 P2 – a semi structured interview

Summative interview – final data collection phase

Further details of the implementation process are outlined in section 3.1.3.

1.4.1 Key approaches to methodology

As part of the PhD studentship programme, training was available for certain aspects of research methods. However within the area of design research the approaches that are utilised need to be fit-for-purpose in terms of appropriately testing the research thinking. This section has been incorporated to outline the key sources of information on each of the approaches taken.

As one of the more developmental approaches to data collection, knowledge elicitation is an approach that can incorporate a number of techniques to bring together information. The articles by McNeese *et al.* (1995) and Nosek and McNeese (1997) formed the main touchstone for this approach, in a way that outlined the research principles for solving problems in more complex and dynamic environments. The exercise that was devised had two main elements: a series of standardised word lists that participants were invited to personalise; a section which followed on from the wordlists where the participants were asked to create a process map to illustrate their understanding of processes involved in their role and by their sector. The word lists were considered as an effective way to elicit terms and phrases currently used within the sector, in a way that would identify any universal terminologies (Comrie, 1981; Clegg *et al.*, 1999) that are being used. The approach to diagram creation was influenced by techniques in concept mapping (Kinchin, 2000; Hughes, 2001) and

cognitive mapping (Swan, 1997; Rodhain, 1999) as well as the texts that outlined the importance of the visualisation of thinking (McKim, 1980; Root-Bernstein, 2000).

There were also more formal elements to data collection which was in the form of questionnaires and interviews. Prior to undertaking either, reference was made to Robson (2002) as the main source, also Oppenheim (1992) and Bernard (2000).

As focus groups formed a significant part of the data collection process within this study, identification of a usable text was important. The book by Langford and McDonagh (2003) proved to be of great value as it had been created for use within design and ergonomics to improve the product development process. Other sources of information on focus group practice were identified in Kidd and Parshall (2000), Robson (2002) and Putcha and Potter (2004).

Analysis tools were also a key consideration. The identification of modes of analysis suitable for the developmental approach was vital, those that emerged as most important were: Oppenheim (1992), Coffey and Atkinson (1996), Bernard (2000), and Robson (2002). For 'systems thinking', Checkland and Scholes (1999; 1999) were important in outlining the required approach to dealing with complexity. To ensure the overarching grounded theory methodology was approached appropriately, in taking a mixed methodology approach, reference was made to Strauss and Corbin (1990) with Strauss being critical in the development of the grounded theory approach.

1.4.2 Extraction

The extraction phase formed the initial data collection, which in turn created the basis of the subsequent consolidation and cohesion stages. This phase incorporated three data collection components;

E1 P1 – Developmental component of the study a knowledge elicitation exercise devised to elicit tacit knowledge through the use of personalised word lists and process mapping techniques. This mechanism for data collection was to used identify terminology and phrases currently being used within the sector and gain insight into industry processes. The approach was created as an interactive form of data collection, which was more involved than a standard questionnaire, yet generates analysable results. The majority of the exercises were completed on a one to one basis, not as a questionnaire, with the participant following standardised instructions.

E2 P1 – A concise questionnaire devised to be implemented within a trade fair environment. Formulated to obtain company and product details, the questionnaire incorporated predominantly tick box questions to ensure they were completed in minimal time.

E3 P1 – Questionnaire devised to query retail sector representatives on their role and their interaction with industry specific technologies. The content and the format were devised to be straightforward as they were distributed electronically to be completed at distance then returned. Using a combination of multiple choice questions and text boxes the format allowed the respondent to add as much or as little detail as desired.

The intention of the extraction phase was to compile the data from each element in order that they could be presented as analysable and usable results. These findings formed the basis of the discursive elements that followed. Using interview and focus group sessions, further query into pertinent issues that had been identified within this extraction phase was made possible.

1.4.3 Consolidation and cohesion

This section outlines how the consolidation and cohesion stages bring together the findings in order to provide structure to the results. A combination of semi-structured interviews and focus group sessions were utilised during this stage;

E1 P2 - A series of three sector specific homogenous focus group sessions, devised with the intention to reflect and refine the wordlist and diagrammatic findings from E1 P1. Designed to be interactive, the content included a round robin exercise, wordlist analysis using magnetic whiteboards, and group discussion for diagram selection.

E3 P2 – The content of the semi-structured interviews were based on the responses gained from E3 P1. Conducted with minimal question relevant to the findings the intention was to gain insight from the conversation that developed.
Summative interview – Incorporated into the study to discuss the findings from all the previous phases with an external party. The respondent was required to have industry experience and knowledge of government agency practice.

The findings from both the discursive consolidation and cohesion elements were in the form of partial or full transcriptions. Qualitative analysis techniques were utilised to

analyse the transcriptions, which were thoroughly considered prior to coding in order to identify key emergent themes within the discussions. Analysis was aided using NVivo, a data analysis software package utilised to further investigate the relationships between themes.

1.5 Summary of thesis content

There are seven chapters within this thesis. The Introduction contains the background to the research subject, outlines the research question and the aims and objectives of the programme, gives an indication of the contribution to knowledge and the limitations to research.

Chapter 2 – The Literature and contextual review identifies and describes current literature relevant to the clothing sector which will incorporate reference to fashion, design, retail practice and other sector elements. A literature map (see figure 2-1) has been devised to show the broader contextual issues that have also been identified as relevant to the research programme. The chapter will outline the main industry components, describe the research focus and précis the considerations made relevant to the study, to describe how the literature has informed both context and process.

Chapter 3 – Research design and methodology, identification and selection of appropriate methods for this programme of study, and the context by which they were selected. The content incorporates the approach to identify respondents from regional MSME's, national high street retailers and international industry technology providers. Also the research methods for each of the three elements and subsequent phases of the study will be outlined using a diagram to illustrate the order and flow of the implementation. The research design approach to data collection will be described, including the incremental knowledge building process and intended form of analysis.

Chapter 4 – The Approach to data collection, explains the application process of each element and phase of the data collection. The systematic approach outlines the preparatory exercise, retailer and technology providers questionnaires, retail sector interviews, MSME focus group sessions and the summative interview. Also included are sections to explain the processes and approaches to data collection and analysis which were used.

Chapter 5 – Presents the Results obtained within the study. The chapter describes the findings and analysis, following the model of extraction, consolidation and cohesion approach (figure 1-4). Both quantitative and qualitative analysis processes were required for the individual datasets, and as the results were considered independently the model ensured that each set of results were built into the subsequent phases. The findings from the consolidation and cohesion phases were qualitatively analysed and summarised to identify any emergent themes in order that they could be considered further, to generate representative theories.

Chapter 6 – The Discussion, engages with the key points emerging from the research process and findings, analysing and discussing considerations in further detail. The emergent concepts arising from the results are then grouped to devise theoretical frameworks and considered using the grounded theory approach. This chapter also provides the opportunity to further consider issues and inconsistencies that became apparent during the study. Also considered were industry needs relative to technology identification from which conceptual ideas for potential solution were devised. The approach to research is reviewed and a critical analysis undertaken.

Chapter 7 - The Conclusion summarises the findings pertinent to the research programme, also the research approach, outputs and outcomes are reviewed. An outline of the key contributions is provided with accompanying précis, and opportunity is also taken here to propose topics for further research.

1.6 Contribution to knowledge

This research adds contribution to new knowledge in four principle areas;

- A contextualised insight into the UK clothing sector incorporating opinions from regional MSME businesses, high street retailers and technology providers
- Development of a new methodological approach
- Formulation of a theory that articulates the current industry position relative to the identification of new technologies
- Identifying the detrimental effects of lack of 'community' existing within the sector

The study began with the intention to identify how the industry currently exists, in order to propose effective change. As the research progressed the validity of the undertaking became increasingly apparent due to the issues involved in the implementation in the use of technology for change.

The process of identification of suitable businesses to be involved in the study illustrated the variety of differing needs associated to diverse businesses and organisations. The apparent multiplicity of needs requires an approach devised to accommodate the requirements of the disparate companies across all industry sectors.

1.7 Limitations of the research

There were very few limitations encountered during the completion of this study;

- The clothing industry sector as a subject area offered extensive choices for research focus and approach. Secondary research was crucial in informing which subject was most relevant.
- Use of developmental methodology meant that formal guidance relating to application was restricted, therefore benefiting from the heuristic approach that was adopted.
- Reluctance in commitment of time and sharing information was shown by industry representatives. This is an issue to consider for future research.

Chapter 2 Literature and contextual review

2.1 Introduction

In order to fully consider the clothing industry sector and the technology available for use within it, this investigation has taken into account both the structure of the apparel sector and external influencing factors. A cross-disciplinary approach was adopted in order to show the breadth of the field of research.

Understanding the aspect of the literature review journey that focused on the clothing sector will further illustrate the issues faced within the industry to identify specific information about new technologies. The approach was devised to consider the interdependent relationship between the sector and the technologies. This was necessary to gain an insight into how industry practice relative to technology use was affected.

Trade press is principally aimed at the trade sector which, within the current UK climate, focuses on retail. This was found to limit the scope of written features in describing more diverse elements of the sector. The process of identifying suitable and current texts, either in books, trade or academic journals or through online facilities was not straightforward. Texts relating to this subject area were limited and quite dated.

The main source of secondary information relating to clothing industry technologies was journals. For the most current product information two trade journals were used, however articles tended to be promotional rather than outlining generic product details, such journals included UK based Drapers and US based Apparel. Obtaining descriptions of practical technology applications was generally difficult. Generally academic press tend to focus on developmental research based on the use of technologies to be focused on a particular area, which at the time of writing included topics relating to 3D bodyscan data, supply-chain management and fast fashion. The academic journals that were most fruitful for references were the Journal of Fashion Marketing and Management, the Journal of Textile and Apparel, Technology and Management and the International Journal of Clothing Science and Technology. As there have been limited books discussing clothing industry practice, the researcher identified three relatively recent texts that have a focus, or element of focus on the

sector Applebaum (2000), Tyler, Carr and Latham (2000), Jones (2002), Cooklin, Hayes & McLoughlin (2006) and Beazley & Bond (2003).

In the instance of this research the literature and contextual review has required the researcher to draw upon multiple sources to identify current trends in practice and processes. This is due to few texts being available relating to this area of study. The most current source of product information is found in industry trade journals, in which products being marketed are those that are 'front-end' and therefore considered relevant. It is common for these types of journals to be influenced by market driven sales and can be the case that the facilities they are promoting are the products aimed at the large rather than the small organisations. This form of product communication often does not offer much insight into product capabilities, and can be rather subjective. When such articles are the only source of information their content must be objectively reviewed to gain value.

The intent of this chapter is to illustrate the journey undertaken during the evaluation research process, and also to acknowledge the diversity of factors influencing the subject of study. Firstly, contextualisation of the current environment of the sector through the identification and discussion of key industry issues is provided. This is followed by two further components of the research focus; an overview of contemporary industry specific technologies available, and an insight into the importance of MSME businesses to the UK clothing and fashion industry to inform the research process.

A map of the research area has been created to illustrate the diversity of subjects taken into account within this programme of study. This can be seen below in figure 2-1. It shows how the main areas of the focus at the centre of the diagram, surrounded by the generic subject area clusters that evolved to fully consider the main area of interest. The structures of the clusters were formulated to evidence the sources that were taken into account. The references relative to the areas identified within the diagram can be found within the text of this literature and contextual review chapter.

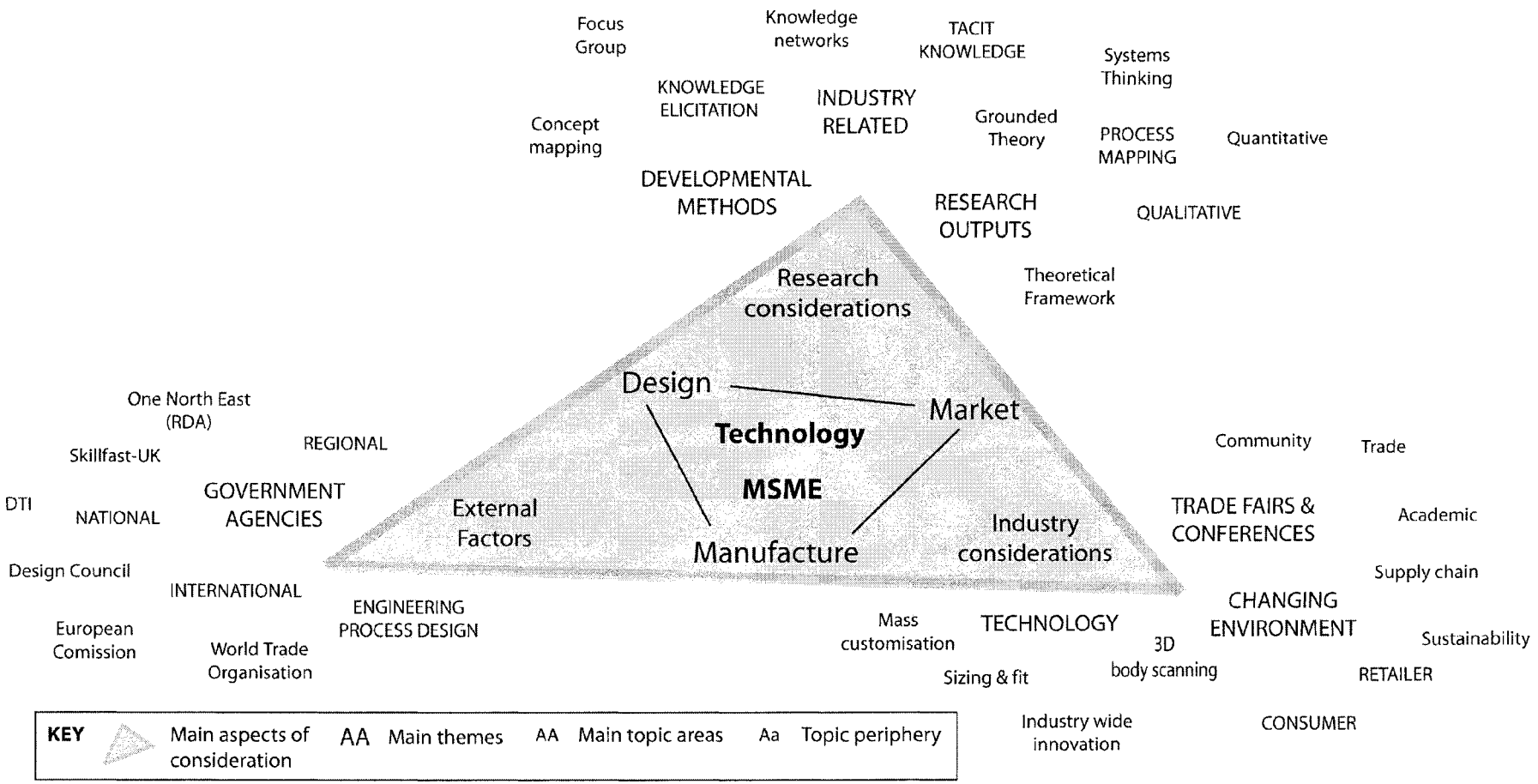


Figure 2-1 Literature review map

2.2 Contextualising the identified clothing industry sectors

As previously explained in section 1.1, for the purpose of this research the term '*clothing industry*' is used to describe an industry having three main sectors: design, manufacture and market. In order to gain a clear understanding of the connections existing within the industry sector, an ontological process was adopted:

- Seeks to describe the basic categories and relationships of being, to define entities and types of entities within its framework (Wikipedia, 2007c)
- The branch of metaphysics that deals with the nature and of things or of existence (Robinson & Davidson, 1996)

The diagram shown below in figure 2-2 illustrates how the core clothing industry sectors are in turn influenced by three external factors; technology, the consumer and external government influences. This research identified that technology and the consumer directly influence the clothing industry, whereas external government influences are seen to affect and encompass all aspects. These factors became apparent through consideration of the drivers and the restrictors of the sector (O'Kane, 2007), in this instance technology could be present as a potential driver, yet it is restricted by the level of availability and use. The consumer could also be considered a driver, as their constant need for more clothing items maintains the buoyancy of the retail sector. The government could be considered both, a driver in the respect that there are policies in place to encourage development within the industry, but also as a restrictor by the level of influence they have over most elements of the diagram in the control they have over interest rates, and therefore the entire retail economy.

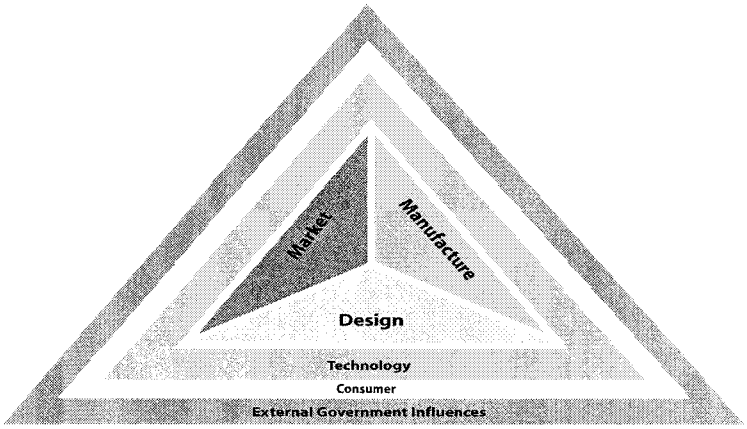


Figure 2-2 Representative model of the Clothing industry sector

Working towards gaining an understanding of how these three central components exist and interrelate will form the basis of this research. Crewe and Davenport's (1991) text, based on the clothing retail sector, provided a pertinent description of the entire sector relating to the tasks undertaken within this study:

> The unravelling of such inter-organisational and inter-sectoral relationships is a complicated task for a variety of reasons. Firstly, the clothing retail sector is by no means a homogenous entity with which to deal, since it is dissected across a variety of dimensions, including size, ownership and market segment
>
> (Crewe & Davenport, 1991)

Within this section the key industry components will be outlined and both consumer and the government influences will be considered. Section 2.3 outlines in more detail the technologies relative to the clothing sector.

2.2.1 Key industry components: Design, Manufacture and Market

In order to incorporate a structure to the study and the findings, it was considered appropriate to query the different elements within the clothing industry sector. These elements were identified as design, manufacture and market as terms to encompass tasks and processes at the different stages through the product lifecycle which were illustrated in figure 1-2. There was an initial realisation that understanding the entire process would be a complex task, an observation supported by Crewe and Davenport (1991) in this retail sector quote, which articulates well the situation across the entire clothing industry:

> ... the clothing industry is also a problematic focus for study, since there exists not one simple 'industry' but, rather, a highly diverse and fragmented variety of organisations which deploy different production and labour processes, are of different sizes and have different production, marketing and sales goals.
>
> (Crewe & Davenport, 1991)

Dunford (2002) suggests there are three main types of clothing enterprise; those who design and market clothing; the manufacturers; and the privately owned, vertically-integrated enterprises who design, make and sell clothing through their own and possibly other distribution networks. Whatever the function of the business, each industry sector is reliant on another, as in this sector which it is common for businesses

to exist independently to achieve their common goal (Jones & Hayes, 2004). This section will outline the main considerations of each of the three identified sectors.

Design, as an element within the sector is a term that encompasses both the process and profession. In this instance the term design refers to the processes that occur from the concept of the design to the creation of the final garment sample. However as a sector, design influences and connects the whole industry from product idea, to development and production. It is able to influence the look and feel of retail promotion. Associated with the success of a design is the 'fashionable' element of the product (Jones & Hayes, 2004), with the design offering value to the product, quality, prestige, and ultimately kudos to the brand.

Since the offshore shift of production in the late 1990's (Tyler, Carr & Latham, 2000; Jones & Hayes, 2004) it is increasingly common for the designs created in the country of retail to be produced overseas then shipped back to be sold in stores (Appelbaum, 2000). As the shift of production was prompted by economies of scale and increased demand from the consumer there have been changes in the role of the designer, increased numbers of styles, and quicker turnover required (Tyler, Carr & Latham, 2000). This area has also been considered by Aspers (2005; 2006) who has undertaken a series of studies which investigate current aspects affecting garments that are produced in geographical locations far removed from the UK. These studies considered the ways in which these manufacturers have been able to gauge the tastes and needs of the European clothing consumer.

The manufacturing sector of the industry has undertaken some significant shifts since the mid 1990's (Tyler, Carr & Latham, 2000; Jones, 2002) due in part to an economic change of climate, and the effect of globalisation. Many large scale manufacture based companies shifted facilities offshore to take advantage of the lower production costs (Tyler, 2003), in order that they could aim to maintain a presence in the UK. The reasons these businesses opted for this shift is in part due to their vulnerability relative to cost, as well as the additional pressure of conforming to the criteria's of quality and speed (Taplin, Winterton & Winterton, 2003) which are the expectation of the high street retailers. The overseas production approach allows established UK businesses to retain a presence onshore, whilst production takes place offshore. The philosophy behind this approach is that the knowledge base, and where relevant the intellectual property is retained in the UK whilst the more cost effective production occurs on the other side of the world.

The market sector has identified, (Taplin, Winterton & Winterton, 2003) that diversity is required in order to cater to wide-ranging consumer sectors with a variety of shopping needs. Commanding the most dominant sector of the clothing retail market are the large-scale high street retailers. The majority of clothing purchased in the UK is through the high street retail companies, either based in town centres or increasingly the out-of-town shopping centres. This sector includes department stores and specialised chain stores generally offering own-brand goods through high street branch stores (Dunford, 2002). These organisations are in constant competition for consumers, often using price reductions to ensure continued trade. As a result of consistent downward pressure on prices, large retailers have created a market environment of which they have near complete control (Dunford, 2002). As previously mentioned, the pressure exerted by the retail sector had dramatic effects on the national manufacture base, resulting in the majority of large-scale manufacturing units closing UK facilities in favour of cheaper off-shore production.

In comparison to the high street, independent retailers and designer outlets are generally sole traders and partnerships, with a business based on a single shop unit. It has been identified that within the clothing retail market the role of the traditional independent retailer appears to be diminishing (Dunford, 2002), due in part to the market shift brought on by the dominant high street retail chains. This type of business generally establishes their own local niche market, this allows them to source goods for the market segment they have identified as their target customer base. In general, availability of outsized garments within the designer outlet sector has been identified as being significantly restricted due to the limited size ranges available within that type of store (Otieno, Harrow & Lea-Greenwood, 2005).

Mail order is an important form of distribution for apparel, another term for this sector is remote retailing. The concept of this mode of shopping is that all goods are stored in a central warehouse or distribution centre, which reduces the overhead costs incurred through high street property rentals. The consumer selects the goods either from a catalogue or increasingly through an online shopping portal, goods are ordered and sent directly to the consumer. In the past, mail order has often been considered a less favourable mode of purchase by many consumers, as garment ranges available were often restricted and generally sold at a premium price. However, following on from the success of the NEXT Directory as part of the NEXT concept (Crewe & Davenport, 1991; Helman & Chernatony, 1999) in the late 1980's, mail order has evolved considerably both in terms of the increased number and diversity of companies offering

a mail or online order facility. In addition enhanced products and services have been made available, extended size ranges have been introduced, increasing numbers of specialist market sector catalogues or sites introduced, all of which are increasing sales opportunities.

Supermarkets as clothing retail outlets are a recent addition to the sector. Over the last ten to fifteen years, supermarkets have been increasing their clothing retail sales levels. Pioneered by the 'George' at ASDA product ranges, Tesco and Sainsbury's has also followed suit by offering garment ranges at low prices. It is a sector that has grown fairly rapidly, predominantly due to the competitive pricing of items combined with convenience of the merchandise which is targeted directly at consumers in the store for their weekly grocery shop. Identified by Otieno (2005) as a popular option for outsized consumers, the supermarket environment offered only limited ranges to that market segment, which could be considered a wasted opportunity.

An additional aspect of the retail sector is the 'discounters'. Identified by Jones (2002) as one of the most important shifts in retail trends, the rise in popularity of the discounters such as Matalan, TK Maxx and Primark have increased the level of pressure to the existing high street retailers to reduce their prices still further. This type of store offers an outlet for out-of-season stock and seconds from branded retailers, designers and manufacturers to be sold on at a reduced price. Consumers are increasingly embracing these outlets due to the diversity of products available often at a much lower cost.

A further facet of the sector are retailers that specialise in mass customised goods, and is a component that is relatively new to the clothing marketplace (Anderson-Connell, Ulrich & Brannon, 2002). The term 'mass customisation' is used across industries to describe products made to individual consumers' requirements within a mass production environment which in relation to clothing is similar to bespoke garment creation. American retailer Lands' End (Devarajan & Istook, 2004), and Bodymetrics which is based in Selfridges, have both been using bodyscan technology to scan prospective customers then superimpose virtual garments onto the scanned form to illustrate garment fit. As the technology has advanced these companies are now able to offer a bespoke garment service; the customer is scanned, they select a garment style and colour, the bodyscan data is used to produce a made-to-measure garment within an allocated period of time.

The consideration of each of these elements of the retail sector illustrates that there are many factors that affect the industry, including the ways in which they adapt to remain, and how it has evolved in order to enhance its competitiveness.

2.2.2 Consumer

Within the UK, consumer society has significantly evolved. This observation relates to the ever changing market place, increased choices often at reduced prices which results in consumers becoming increasingly demanding in terms of product variety and uniqueness (Ulrich, Anderson-Connell & Wu, 2003). This being the case, consumers ultimately have buying power behind them, if they are not happy with the style, choice, price or service they can take their custom elsewhere. In terms of current consumer attitudes towards clothing, there was a TV discussion (BBC Breakfast, 2007) suggesting there is a shift in the factors that influence consumers to purchase clothing. The conversation was based around the findings of a report by the corporate research organisation Verdict (2007), which had given extensive consideration to aspects of the European clothing sector.

According to Bolisani (1996) consumer behaviour is rapidly changing, in a way that designer items are losing their appeal whilst the desire for intrinsic quality for a lower price is increasing. Anderson-Connell *et al.* (2002) put forward that consumers are increasingly inclined to look beyond traditional retail outlets for the products they require. Factors identified by Otieno (2005) as 'triggers' that affect a consumer's desire to purchase clothing items: availability, fashion, fit, comfortable changing rooms, clothes enjoyment, personnel attitudes, bodysize characteristics, pricing prescriptions and product display.

As consumers are known to develop their own intrinsic knowledge and experience of the fit of garments (Tselepis & Klerk, 2004), which can be constantly updated as more products and brands are encountered. This links to research conducted by Goldsmith (2002), who advocated that heavy users of clothing develop an innovativeness, involvement, knowledge and opinion leadership common with that of high users of wine and travel.

In order to ensure consumer satisfaction, it is vital that their needs are considered and addressed. Within most societies across the world, clothing could be considered a staple product (Kawamura, 2005), as being clothed is considered the norm. Product

wise, the clothing retail sector could be considered a fairly lucrative market, with fashions, in terms of styles and colours are constantly changing. Also, retailers have had to provide increasing numbers of new styles for consumers to buy. The majority of garments sold within UK high street stores are based on standard sizing charts originally developed during the 1950's, or retailers variations of these charts, with a limited proportion dedicated to outsized garments. For the most part the consumer has to conform to the available sizes when purchasing clothes as alternative better fitting clothing is generally not available. Research conducted by Anderson-Connell et al. (2002) identified that in the United States there is widespread dissatisfaction associated with the sizing and fit of mass produced apparel. Taking into account the evolving needs of the consumer is paramount to the successful future development of the clothing sector.

In addition to existing customer needs, retailers must consider that across the world, population demographics are also changing. These changes relate not only to cultural movements through immigration, also better nutrition improving health and lengthening life spans, but more sedentary lifestyles can lead to obesity, each of these factors can affect the size and shape of product. Focusing on apparel, research dedicated to the fit of clothing has been ongoing since the 1970's (Simmons & Istook, 2003) with more recent work concentrating on the potential applications of newly developed bodyscan technology (Jones, 2002; Simmons & Istook, 2003; Ashdown, Loker & Adelson, 2004; Treleaven, 2004). Gaining an understanding of the diversity of shapes and sizes of the human form will illustrate where current provision is lacking as well as areas of potential opportunity through the use of new technologies.

The extrinsic clothing needs in relation to the psychological factors involved in clothing purchases must also be taken into account. It has to be considered whether consumers would want change in terms of current sizes available, or if the majority of consumers are satisfied. According to Tselepis and Klerk (2004) the experience of purchasing a well fitting garment not only offers extrinsic satisfaction, but also the garment is able to considerably affect the purchasers' emotional and cognitive pleasure, thus satisfying their socio-psychological needs. This relates to the element of clothes' shopping that could be considered a social occasion (Choi, 2003). Each of these factors reaffirm that it is critical that the retailer is aware of the intrinsic and extrinsic needs of their consumers in order that they retain and refresh their interest in the products.

2.2.3 Government agencies and industry bodies

As previously identified in figure 2-2 the clothing sector is encompassed by external government influences. These influences are dictated by different government enterprises with various responsibilities. This section will identify significant regional, national and international bodies relevant to the clothing industry.

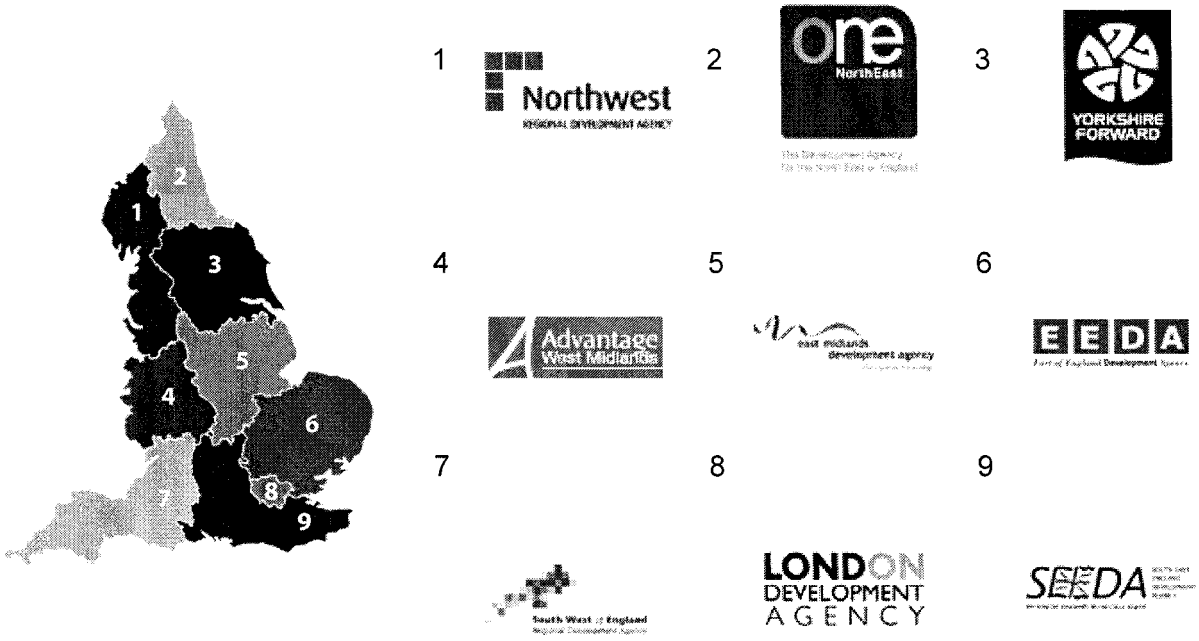
In order to ensure the longevity of the clothing industry, a number of national and European based bodies and organisations have been formed to aid the sector. In the UK, the government agencies/bodies include Skillfast-UK (2004b), the Sector Skills Council for apparel, footwear and textiles, also Technitex (2006), devised to encourage research, design and development within the field of technical textiles. The Industry Forum is an organisation originally formed through a joint government/industry initiative created to improve supply-chain performance, also the British Clothing Industry Association (BCIA) and the Association of Suppliers to the British Clothing Industry (ASBCI) exist as a source of information to businesses within the sector. In addition, the British Fashion Council is the national body created to be the 'official voice' of the UK fashion design sector, with the Society of Dyers and Colourists (SDC) in place to advise garment and fabric producers on colouration issues. In the UK research relating to the sector has been funded by the European Research Development Fund (ERDF) and Engineering and Physical Sciences Research Council (EPSRC). In terms of EC based research organisations created to aid the industry, Euratex (2005) and LEAPFROG (2005) are two agencies created to encourage technological breakthroughs across the clothing industry sector. The principal non-government related organisation is the Textile Institute (2003) which exists as a registered charity, it is a professional body associated with the textiles and clothing sector with individual and corporate members across 90 countries. Further details on all of these agencies and bodies can be viewed in appendix 15.

There is also a less obvious government agency, the Department of environment, food and rural affairs, Defra (2007) which is undertaking research into the sustainability issues relating to the clothing sector. Ongoing studies are being implemented in line with agencies such as ERM (2007) and also Chatham House (2007) to devise more stringent guidelines to increase the sustainability of the sector (Massey et al., 2007). The document by Massey outlines the priorities of an ongoing study which will use a carefully selected stakeholder group to consider current and future industry status. Even though sustainability is not one of the principal areas of focus for this study, it has been recognised as a component of industry practice that will become increasingly

important. The ongoing development of government policies will form the regulations that will stand as more powerful drivers and enforcers of the much needed change within industry practice.

Each agency or organisation has the common goal of helping the clothing, textile and fashion sector, however each works to their own guidelines and remit. These agencies have been created with the intention to aid, advise and guide businesses, that often experience difficulty in identifying the opportunities as from an industry perspective it is unlikely a practitioner within a clothing or textile organisation would know what to look for. Staying abreast of all the policies, strategies and advice that is available from these bodies can be difficult because they are regularly revised or updated.

Due to the effect that increased offshore production has had on all areas of UK manufacturing industries, the British government introduced appropriate mechanisms of support and development to businesses both nationally and with a more focused regional basis. Formed to promote sustainable economic development throughout the country within the UK there are nine Regional Development Agencies (RDA). The task of each agency is to improve their regions relative economic performance whilst reducing economic disparities between other regions (RDA, 2005). As each agency is business led, regional economic development solutions are devised according to the strengths of each region. The map below in figure 2-3 indicates each of the nine agencies across Britain, the numbered logos to the right relate to the geographical regions. The RDA for the North East is One North East (ONE), the remit of which covers the geographical area shown uppermost on the map below, from the Border region in the North, to South of the Tees Valley estuary.



Source: (RDA, 2005)

Figure 2-3 Map illustrating of the Regional Development Agencies of Britain

One of the developmental requirements the RDA's is their responsibility to encourage the creation of regional cluster groups. The encouragement of innovation through knowledge transfer is also paramount, resulting in structured agendas being devised to encourage the formation of regional cluster groups, which are small groups generally linked by a common business interest formed independently of business practice. These groups are not only encouraged to exist within and between industries, but also to develop relationships between industry and Further and Higher Educational (FE/HE) establishments. These issues were outlined by Lord Sainsbury of Turville (2003) as Parliamentary Under-Secretary of State for Science and Innovation, responsible for promoting world class science and innovation, within a keynote speech at the RDA Clusters Workshop held in 2003. The government is committed to the development of cluster groups within all areas of business environment, which is outlined in the passage below;

> Clusters play a key role in driving economic growth in localities, cities and regions. Clusters create an environment where companies can share best practice and save costs through joint sourcing. They create an environment where knowledge transfer is encouraged, and organisations can make best use of each other's skills. In short, they create an environment where innovation flourishes and productivity grows. In creating a co-ordinated and consistent

> policy environment that encourages cluster development, we can make a major contribution to increasing the innovation performance of this country.
>
> (Lord Sainsbury, 2003)

Reference must also be made to the status/relevance of the Standard Industry Classification (SIC) codes1 (2007) used by the government to earmark the classification of a business type, these can be viewed in appendix 3. It is commonplace for companies to be classed under a SIC code that is inaccurate. These inaccuracies present limitations for the organisation in question as they may be grouped into a sector in which they have no common interest. This observation stemmed from discussions with Uldis Revelins a colleague from the Coventry Clothing Company, a government associated agency servicing the sector.

To summarise, though the government agencies have been tasked to aid the sector, the agency roles have been dictated by their underlying remit, of technology transfer and bringing new commercial opportunities into their region. Their sphere of activity has initially been transposed into the development of more prescriptive and rigid guidelines by which to aid their sector. These guidelines are predisposed by the SIC codes allocated to them, within appendix 3 the SIC codes relating to the clothing and affiliated products are outlined. However, this can result in situations where such prescriptive allocation may limit the aid provided to those areas, if they are not as directly related to the SIC key area of responsibility (Revelins, 2007). From this perspective, the agencies might be considered inhibitors rather than enhancers of opportunity in some of the less directly related instances.

2.3 Research focus; outlining industry specific technologies

This section will provide an indication of the varied types of technologies available to the clothing and fashion sector and issues of identification faced by potential users. In order that the reader is able to further understand the detail behind the technologies considered, further product details are available within the company profiles provided in appendix 15.

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[1] A Standard Industrial Classification (SIC) was first introduced into the United Kingdom in 1948 for use in classifying business establishments and other statistical units by the type of economic activity in which they are engaged. The classification provides a framework for the collection, tabulation, presentation and analysis of data and its use promotes uniformity.

As the content of this section will illustrate, the choice of technology available to the sector is very wide ranging and offers different levels of capabilities, facilities and solutions, with concentration principally on industry rather than mainstream information communication technology (ICT) use. The diversity of technological facilities available to the sector raises an issue of how small businesses could competently make a decision on the types of facility they require. This is further inhibited by the limited source data relative to the products available to this market.

2.3.1 Mainstream technologies available to the sector

Identification and understanding of the application of technologies within the clothing sector was an influencing factor in the decision on the research subject identification. It was developed from the researcher's basic working knowledge and interest in different types of technology available to the sector. Current literature was identified to illustrate technology related to fashion and clothing, a sector with many varying processes and practices. This section outlines the types of industry specific technology currently available to companies from design to distribution of finished goods, in addition developmental and new opportunities for technology use are identified.

This section has been broken down into thematic sections that are reflected within the data collection phases; Design and product development, Sourcing, logistics and transport, Retail and Manufacture.

2.3.2 Design and product development

Within clothing and fashion, significant technological development has evolved around the use of ICT, since the introduction of Computer Aided Design and Manufacture (CAD/CAM) during the 1980's. When considering CAD, there are the core, long established design Personal Computer (PC) or Apple Macintosh (Mac) based systems (Ross & Schuldt, 2006), which enable designers to create designs and sketches electronically. To complement the basic design programmes, standardised electronic colour palettes which are electronic versions of the colour chart shown below in figure 2-4. This type of facility is available to ensure an effective colour approval process remotely (Speer, DesMarteau & Cole, 2005).

The facilities offered by CAM systems allow designs to be translated into a digital pattern, which is graded to all size requirements. From the digital pattern, a cutting

plan marker is generated, offering the capacity to link to computer controlled cutting devices (Beazley & Bond, 2003; Ulrich, Anderson-Connell & Wu, 2003). As the CAD/CAM processes are electronic, it is possible to transfer files via disc or emailed as required.

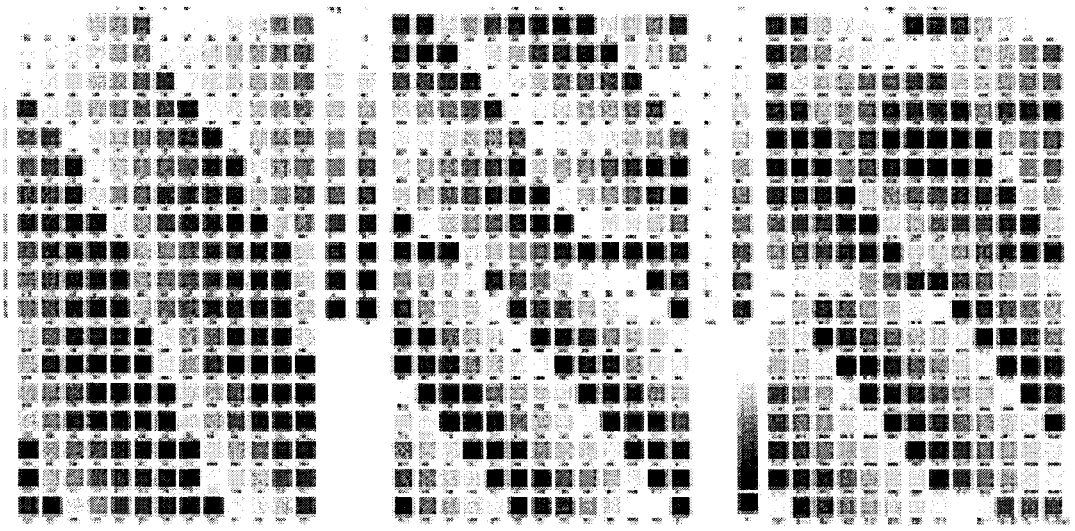


Figure 2-4 Static version of standardised coded colour chart (original in colour)

Businesses are able to use a combination of these technologies enabling them to function effectively with different roles spread over a number of geographical locations (Speer, DesMarteau & Cole, 2005). These types of claims made in clothing sector trade press illustrate to readers the benefits obtained by businesses operating in multiple locations, or as a provider of individual services. However in this instance, the source of this product information came from a US based journal meaning that the UK target audience may be limited to relatively few organisations that have subscriptions.

Introduction of the more recent product development technologies has had a dramatic effect on front-end industry practices (Speer, DesMarteau & Cole, 2005). There are two generic terms used to describe the type of programme/facility used, product lifecycle management (PLM) and product data management (PDM), both of which are similar in concept. Developed from engineering sector-based models, they offer improved communications between clothing manufacturers and retailers, to increase quality and reduce development time. PDM allows all garment specification data to be stored electronically, this includes pattern information, garment construction requirements, fabric, trim and label information and quality and measurement specifications (Beazley & Bond, 2003).

These PDM and PLM systems offer businesses increased levels of product visibility (Speer, DesMarteau & Cole, 2005), with the additional benefit of allowing external parties to update their relevant areas through secure online connections. Use of this type of technology allows businesses to input, upload, store and update product specific information, for multiple products during the development and pre-production phases. The practical implications involved in the implementation of a PLM/PDM system not only relate to financial cost, but also the levels of commitment required across the entire business during the often significant transition phase. The time element involved in the transfer from an existing system to a new one, or if there was previously no system in place is a considerable undertaking, and often considered to be a restrictor to change (Jones, 2002).

2.3.3 Manufacture technology

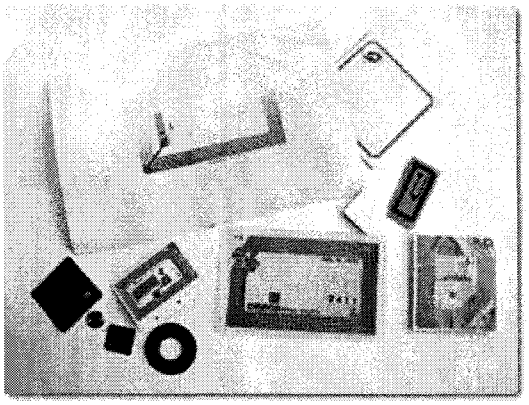
Devised as a solution to supply-chain management Enterprise Resource Planning (ERP) is a facility that enables effective monitoring of multiple components through the production process, or Work in Progress (WIP) with the capacity to monitor multiple styles options over a number of production sites. The types of ERP technology available include; Inventory Management Systems (IMS) to aid in raw material stock control, Electronic Data Interchange (EDI) that offers real time finished goods stock analysis through the scanning of barcodes, and with the recent surge in popularity of online shopping for clothing there is the e-Business or Enterprise Application Integration (EAI). Following the supply-chain, further technological developments also occurred at subsequent stages such as sourcing and logistics.

According to Speer *et. al.* (2005) those within businesses responsible for sourcing finalised products to sell now have the facility to increase their involvement in new product development to ensure they are aware of critical styles and their requirements. Similarly for logistics, technology use increases the levels of visibility of goods in transit. Each of these new types of technological facilities complement each other in a way that there is increased levels of downstream and upstream systems integration (Speer, DesMarteau & Cole, 2005).

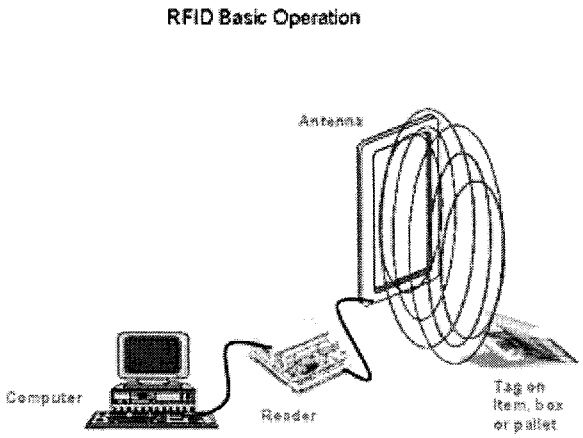
2.3.4 Sourcing, logistics and transport

Once the finished garment has left the production line, it then enters the realm of warehousing and logistics. The product in hand may have been produced locally or

shipped in from overseas to be stored prior to final distribution. The technological capabilities in this element of the product life cycle offers the facility for deliveries to stores be relate to specific regional demographics. Also there are now automated systems that are able to 'pick' garments from storage, to 'pack' them for distribution (Speer, DesMarteau & Cole, 2005) removing the human element of the process. One of the technologies that is transforming the logistics process is the use of radio-frequency identification tags (RFID), see figure 2-5 below, this technology allows goods to be transferred between locations without the need to scan individual barcodes.



A variety of RFID tag formats and packaging, the large loops that can be seen on some of the tags are the radio antennas that allow the tag to communicate with the reader



Source: (RFID, 2007)

Figure 2-5 Illustration of RFID tags and operation principles (original in colour)

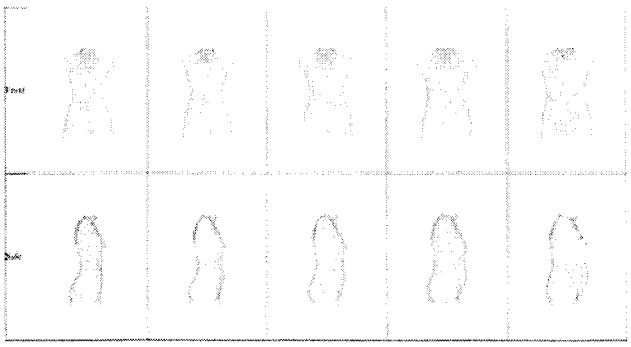
2.3.5 Retail technologies

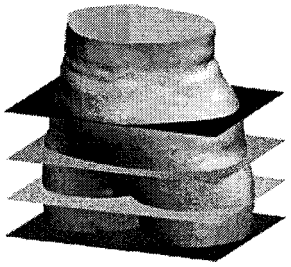
The retail sector of the industry also has technological facilities devised to aid and maximise the sales potential of stock. One of the long established facilities is electronic data interchange (EDI) which through the scanning of barcodes, or explained in the previous paragraph RFID tags, to ensure stock levels are effectively monitored. This visibility of stock enhances merchandising capabilities as well as inventory of goods (Speer, DesMarteau & Cole, 2005). Previously this type of technology was only utilised by large scale organisations, however according to Cole (2005) this technology is increasingly used by smaller organisations.

2.3.6 Developmental clothing technologies

An area at the cutting edge of clothing technology is 3D digital body scanning. This technology has the capacity to scan the human body and extract in excess of 130 critical measurements (Simmons & Istook, 2003; Bruner, 2004). The process was

developed to obtain body measurements in a non-physically invasive way, and offers a realistic alternative to the highly skilled and time consuming anthropometric approach to measurement of bodies using a traditional tape measure (Ujevic, 2006). Specialist software was developed to extract body size data from the readings, allowing the measurements to be viewed in 3D or transposed into 2D in order to be applied to standard pattern pieces. The extracted data forms an extensive database from which computer generated point cloud figures and 3D models are created, examples from the Bodymetrics (2004) and Cornell (2003) websites are shown below in figure 2-6. Also surface area, volume, body slices which are shown in the image on the right and allow the virtual form to be sliced in order that the precise circumference measurement can be taken to determine the size (Ashdown, Loker & Adelson, 2004).





Source: (Bodymetrics, 2003)

Figure 2-6 Example of point cloud figures and 3D body forms (original in colour)

Further uses of 3D scanning technologies offers the facility to fully automate pattern grading, marker making and computer integrated manufacture such as cutting (Choi, 2002). This is possible through developments in CAD tools, giving the user the ability to generate a 2D pattern, that within the virtual environment are applied to a 3D model (Beazley & Bond, 2003). This is possible by a 2D pattern being wrapped around a virtual 3D mannequin with model garment, this enables the look of the garment to be altered as required before any physical sample garments are made. In addition, this option to virtually wrap pattern pieces prior to sample making offers opportunities to consider how patterned and printed fabrics will work within the garment design. Beazley and Bond (2003) proposes that this is the likely way forward for the designer and pattern technologists.

To date, the principal application of digital bodyscan technology with its' capacity for quick and effective mass-measurement (Simmons, Istook & Devarajan, 2004) has

been within National Sizing Surveys (NSS). During 2001 the DTI commissioned SizeUK, the first NSS of this kind in the world[2]. Conducted as a government initiative, SizeUK was part funded by the DTI, with the shortfall funded by a conglomeration of high street retailers[3]. This large-scale study obtained the body measurements of 11,000 demographically representative members of the British public, which was compiled to form an extensive database. Information regarding subsequent use of the compiled data is limited, however SizeUK (2005) claims that retailers involved in the study, who have contractual rights to access the data, are 'in the process or have already updated their size charts' relative to the findings from the survey. Beyond this, little is known or published in relation to further use of the data, raising the question as to how justification of such a significant financial investment to conduct the study can be rationalised.

A development occurring since the introduction of 3D bodyscan technology that utilises retail sector presence with manufacturing facilities was the introduction of mass customisation. The term 'mass customisation' devised by Davis (Anderson-Connell, Ulrich & Brannon, 2002) is a phrase used by companies producing customised goods on a mass basis. This facility allows consumers to identify a style of garment that can be made to their own electronically generated measurements, giving a standard style of garment to their own body size. Anderson-Connell *et al.* (2002), propose that as a process, mass customisation will never replace mass production due to the way that part profit dictates production capacity. Bailey (1993) noted that typical garment assembly within clothing manufacture uses traditional mass production processes, however using the mass customisation approach could offer opportunities for manufacturers, retailers and consumers. Consideration of these issues identifies that there could be the potential for each area of the sector to gain from the adoption of mass customisation techniques.

As a developing area of the industry, specialist clothing technology research centres at Auburn (Alexander, Anderson-Connell & Presley, 2005) and Cornell (Ashdown, Loker & Adelson, 2004) Universities in the USA have ongoing research focused on the utilisation of bodyscan technology. In the UK there are also a number of dedicated research facilities based at University College London (UCL) in which the software was developed to translate scan data. Further developmental research is also being

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[2] Subsequent studies have been completed in USA, China, Mexico, Germany, Italy, France, Australia and South Africa. Studies in, South Korea, Brazil, Sweden, Ireland, Singapore and Hong Kong being planned or are underway.
[3] Arcadia, BHS, Debenhams, House of Fraser, John Lewis Partnership, Monsoon, Oasis, Speedo, Tesco, Littlewoods, Marks & Spencer, Rohan, Redcats, N Brown Group, GUS, Grattan, Freemans

conducted at London College of Fashion (LCF), Manchester Metropolitan, Loughborough and Heriot-Watt Universities (Stylios, 2001). The majority of journal articles are originating from a number of key US based academic researchers, including Susan Ashdown (2003; 2003; 2004), Cynthia Istook and Carla Simmons (2003; 2004). Also prevalent is Priya Devarajan (2004) who as a Marketing Research Analyst at Lectra USA, is contributing vital industry insight to the research being conducted.

During the course of the research programme, it has become apparent that effective use of digital bodyscan data offers opportunities for many potential applications across the clothing industry, and beyond. One area in particular is within the engineering community. Articles identified by colleagues in Professional Engineering ('All over body-scanning could mean a better fit,' 2006) and ARUP (2005) illustrate that practicing engineers have an interest in the development of digital bodyscan technology, as it offers 3D modelling capabilities, rapid prototyping and animated film character applications. This broader industry usage suggests the 3D scanning technology will only become more economical and more widely available in the near future.

Integration of sector specific technologies into organisations is one area in which businesses are able to gain an advantage. Another is access to information regarding the sector available through the Internet. Online facilities offered by trend prediction organisations such as WGSN and Just Style provide membership access to current trend data relative to all areas of fabrics, fashion and footwear. During 2006 there was the introduction of 'Drapersblog' (2006), which is an online interactive web log with daily discussion of current, generally retail related subjects. This medium allows non subscribers of Drapers (affiliated trade journal) to be aware of current issues relating to the sector. Developments in services of this type may revive the sense of community within the industry, giving individuals from all areas of the sector the opportunity to feel involved through interaction, sharing perspectives or just occasionally dipping-in to keep abreast of current issues.

2.4 Technology management outside the clothing sector

To contextualise technology use across the wider MSME sector, a supplementary section has been included to illustrate current trends and areas of interest. In terms of documented technology use, Internet technology adoption is most prevalent, with

numerous articles discussing the issues associated with adoption and utilisation of the Internet as an increasingly fundamental technology. Reference has also been made to technologies relating to industry/manufacturing practice. One relatively current paper written by Raymond & Uwizeyemungu (2007) provided an interesting insight into the adoption of Enterprise Resource Planning (ERP) technologies. This has a particular pertinence to this research programme as ERP is a form of technology utilised within larger businesses within the clothing sector. The paper provides viewpoints of 356 companies across 15 industrial sectors.

Consideration of the trends in internet technology adoption, Walker et al. (2003) suggested that within their study of Australian companies that one third of the 194 surveyed had a web presence, of the micro businesses only 15% stated having a website. A prevalent trend within the MSME sector is their unawareness that businesses that use the internet are able to conduct online business transactions both with customers and suppliers. Walker *et al.* (2003) discussed that there is a trend for small and micro businesses to own computers and use the Internet, but that they have a reluctance to commit to supporting their own web presence, which it was suggested could have implications on business possibilities.

Within the UK, the Office of National Statistics (ONS) conduct surveys to monitor trends in population and business practice. In 2007 they published a document entitled 'Focus on the digital age', which considered a range of areas associated with technology use. The chapter outlining e-business practice revealed trends relating to ICT use within small, medium and large businesses, providing an overview of the ways organisations buy and sell using the Internet. One of the key messages that emerged was that in 2005 70% of businesses surveyed stated they had a website, only 15% reported to selling online (ONS, 2007a). As highlighted within the text 'this suggests that the majority used their websites for purposes other than selling, such as product and company information'.

As business and trading processes evolve and develop, technological facilities to enhance practice are often sought out. This trend not only applies to large organisations, but also be MSME businesses working within supply-chain environments. Raymond (2007) outlined the trend for the use of ERP technology, and the way it has developed into almost a requirement for extra-organisational links between clients and suppliers. This has formed an environment with an increasingly

inherent pressure to conform, in which smaller companies have to prioritise investment in technology.

Consideration of technology adoption in the wider context has revealed there are a number of motivators that influence technology adoption: there must be a person within a business who has the vision to see benefits of ICT use, and is prepared to drive the process of adoption to ensure successful implementation; within individual sectors that there is a culture of reaction to publicised benefits; realisation of the importance of globalisation, and the affect it has on trade and industry; the lack of technical knowledge within a sector; concerns relating to obtaining and maintaining a secure system. Each of these issues could effect a business decision to invest. There is also the issue that within the wider context of ICT adoption by MSME sector, Stockdale & Standing (2006) discussed how a reluctance to change can be influenced by a company's adherence to do things traditionally.

This section has illustrated that there are a number of factors influencing, motivating and affecting technology adoption. Cost and speed of implementation are regularly cited as a reason why companies opt not to use technologies. Also there are the issues relating to fear of compatibility and costly ongoing support implications. In terms of motivations to adopt, in certain industry sectors, it is apparent that there is an inherent pressure from within supply-chains to conform with those technologies used by 'neighbouring' businesses in the chain. There are also concerns as to whether businesses are ready to automate their existing processes.

2.5 Importance of the MSME industry segment in the UK

This research considers the significance of the Micro and SME[4] (MSME) sector of the clothing industry. The way in which the sector has evolved has resulted in the majority of the businesses now falling into the micro, small to medium sized enterprise bracket. The following paragraphs outline the types of businesses that fall within the MSME sector, in order to acknowledge the level of diversity within the current UK clothing industry.

[4] Directive published on 1st January 2005 by the EU Europa (2005) *Definition of small and medium-sized enterprises (SMEs)*. [Online]. Available at: http://europa.eu.int/scadplus/leg/en/lvb/n26001.htm (Accessed: 6th March 2003)., offers guideline prerequisites according to the size and turnover (€) of business enterprises, these outlines are used for all industries and sectors.

Micro businesses are considered to be the vital component within the clothing sector, both in terms of retail and production and account for a significant 84% of clothing related businesses in the UK (Skillfast-UK, 2005a). According to a report compiled by Skillfast-UK (2005b) the number of clothing and textile related businesses totalled 31,830, of which 26,830 are classed as micro organisations. Many different business types are registered under this sector, from the manufacturing, trading and services areas. The majority of these micro businesses are sole traders or partnerships, where individuals have an interest in clothing or fashion and are able to take it further. An industry sector breakdown obtained from the NE branch of Skillfast-UK indicates that the majority of micro businesses are registered either as bridal wear providers or alteration services.

Small and medium sized businesses also have a considerable standing within the industry (Skillfast-UK, 2005a). Businesses of this size tend to be established, either from micro businesses that have expanded, or larger companies that have downsized.

Large businesses are very few in number, those that do still trade retain their importance as they account for around one fifth of the people employed in the sector (Skillfast-UK, 2005a). Until relatively recently large manufacturing companies held a prominent position within the clothing industry, however since the early 1990's retail market shifts have affected the clothing industry dramatically resulting in large scale production units being closed in favour of cheaper imports.

2.5.1 Linking technology and the MSME sector

The findings from a study called PROF-IT conducted by e-skills UK[5] in conjunction with Skillfast-UK (2004a) outlines that usage of IT within the clothing sector is less extensive than other sectors. As technology provision for the MSME business organisation is often considered an unnecessary investment or unobtainable commodity. The PROF-IT study also revealed that diverse IT packages have been adopted by the clothing industry, from standard office and accountancy packages to sector specific applications and resource management planning software. In addition, the report illustrates the levels of satisfaction organisations held towards their application of software types as well as the perceived importance of packages over the following three years. However,

[5] e-skills UK is the Sector Skills Council for IT, Telecoms & Contact Centres http://www.e-skills.com/

it seems to have been conducted on a general level as no sector specific technologies were identified.

The types of technology adopted within fashion and clothing can be quite varied, from straightforward ICT to technologically advanced bespoke facilities. Businesses have to consider similar product types offering varying functionality, as some are designed for larger organisations, others specifically created for smaller companies. Choi (2003) explains that within the clothing industry some companies have been proactive in the adoption of certain technologies, whereas others are more reluctant. There is the sense that fashion design practitioners prefer to retain elements of their craft skill base, such as pattern making or garment tailoring, which do not require as much use of ICT. In addition to this is the artisan element of clothing and fashion as craft base trades (Choi, 2003), where often garments produced are likened to high quality artistic products made by craftspeople with the necessary skills and techniques.

In terms of clothing manufacture, it is possible to apply industry specific technologies in a number of ways, for example; computerised cutting from digitised patterns, automating and monitoring stock flow throughout the various stages of the manufacturing process. According to Yan (2002) modernisation of both equipment and strategies is essential for manufacturing firms today. In addition computer technology can be applied to the automation of repetitive sorting, cutting and sewing processes with the use of micro-electronic machinery. However due to the nature of the clothing manufacturing industry, investment on behalf of the suppliers of the technology to the industry has been 'severely retarded by the continued availability of extremely cheap labour around the globe' (Jones, 2002), which has an effect on further development.

Technology devised to aid manufacturing is implemented to assist production processes wherever required using Internet technology to transfer product data. This not only enables the business to communicate via email, with orders being placed electronically, both to suppliers and from customers. It has been identified that within the clothing manufacturing sector less than 50% of SME businesses have Internet access (Beach, 2004). Consideration of this figure suggests that few companies used technology prior to publication of the article in 2004, these findings are also reflected in a number of other articles stemming from studies conducted at a similar time (Pye, 2002; Skillfast-UK, 2004a; ParetoUK, 2005). No more recent surveys directed at the clothing sector were identified to update this figure, however due to the general rise of ICT within UK businesses increasing to 93% in 2005 (ONS, 2007a), and by UK

households to 63% in 2006 (ONS, 2007b) it is likely to have risen. The figure of 50% proportion of companies using the Internet could relate to the perceived cost factor involved in the introduction of new technology into existing businesses (Yan & Fiorito, 2002). According to Jones (2002) the level of capital investment in technology per head in the apparel sector is extremely low, perhaps due to the anticipated cost or potential return on investment (ROI). There are a number of issues relating to, and beyond ROI, that could increase the level of reluctance to adopt new technology. One of the negative factors against adoption of technology could relate to organisation size, with 99.3% of all UK 4.3 million registered enterprises in 2006 registered as being small (ONS, 2006). In the UK, 80% of registered clothing businesses being classed as 'micro' organisations (Skillfast-UK, 2005a), reiterating that 26,830 of the 31,830 registered clothing and textile businesses classed as micro organisations (Skillfast-UK, 2005b), in which case the investment in technology may be considered a lower priority in comparison to other costs. There also exists the 'fear of change' element, where companies are satisfied with their design, manufacture or stock control system and are reluctant to automate. This links to the additional aspect of cost involved in investment, as computer systems and specialist technology generally require a substantial outlay, and continued maintenance upgrading.

Consideration must also be given to the providers of the new industry specific technology for the clothing industry, who create products to gain their highest possible profit margins, often pricing SME businesses out of their market. There is the additional factor that suppliers are generally based in varying international locations, which could affect the level of promotion in different countries. Yan (2002) proposes that CAD/CAM vendors should increase efforts to promote the advantages of their products to the MSME sector, as illustrated by the Skillfast-UK figures they are such a significant part of the industry. Technology businesses should ensure that potential benefits are sufficiently promoted to the SME sector. This includes explanations of other potential barriers which may exist, such as licence fees for use of the technology or data. Fully explaining the precise nature of the technology and how it could benefit a small business that would aid the rationalization of user expenditure, ultimately resulting in increased sales for the providers.

There is also the issue associated with investment in commodities such as technology. There is the concern that its use will generate the results/revenue to justify the return on investment. This is a subject that will be addressed further on in the thesis, see section 5.3.1.1, as it was an issue that was discussed within the focus group sessions.

2.6 Looking outside the clothing sector

One of the aims of the research programme was to gain an insight and understanding of the process and communication that takes place within the sector. As the research progressed it was apparent that no other research of this type was being undertaken within this field, however there had been a number of analytical works and studies undertaken by Eckert (1999; 2000; 2005; 2006) and Clarkson (2005) in the field of engineering design process analysis that warranted consideration. Formally from a knitwear background Eckert (2000), has made the transition to a research subject area involved in design and the cognition and comparison between different domains. Although this work does not entirely mirror the intention of this research programme, there are many similarities in terms of identifying the processes involved then gaining an understanding of the relationships between tasks.

When considering the engineering based studies that observe and map out their product design process using 'computational representations and visual displays' (Eckert, Kelly & Stacey, 1999) to illustrate the interpretation. This is a much more prescriptive and measured approach than that adopted within this study, in which personal interpretations were obtained and considered. However the principle behind the breaking down and understanding of the process is considered to be very similar.

2.7 Limitations associated with the literature and contextual review

Narrative text in the field of clothing and fashion appears to have developed limited formal theory and few explanatory texts outlining current technologies application, resulting in the occurrence of restrictions within the literature review. In terms of identifying current texts relating to the sector, the literature available was far narrower than first assumed, with few key published texts. This resulted in identification of more progressive writings being disproportionately supplemented by industry trade journals and peer reviewed academic journals of the field.

It is important to note that the information compiled within this review has been significantly supplemented through attending industry related academic conferences (listed in appendix 1) and IMB2006, Europe's triennial clothing industry trade fair. Attending both the academic and industry conferences offered a valuable and essential source of information regarding current and developmental practices across the sector through presentations, exhibitions and personal interaction. Therefore it is pertinent to identify, where appropriate, specific product information has been obtained through

promotional product specifications, trade journals and personal understanding of the applications.

As outlined in section 2.1, there is also an issue with availability of texts published that are relevant to the clothing sector. This limited availability of current publications is most likely due to the limited audience. Since the shift in industry production the requirement for clothing based courses, the need for the associated reading matter in the UK has diminished. This issue could be addressed in a way that books aimed at clothing are approached in a different way incorporates the broader sector, combining the elements that are important to the clothing with informative subject matter for courses and students intending to enter the design or product development with a more informed perspective.

The final factor that affected the literature review was the alteration of the focus of the research direction occurring after the Mid Point Progression review, over two years into the study. It was recommended by the review panel that further value to the research would be created by broadening the technological scope of the subject area. The focus of the original conceived idea was therefore altered. The original intention had been to investigate the possible application of 3D digital bodyscan data to the MSME business sector. The suggested change was to broaden the technological focus of the research in order to consider all available sector specific technology. The change in focus required further investigation into another aspect of the industry that offered limited written references relevant to the study.

2.8 Summary of literature

Conducting the literature and contextual review has further reaffirmed the relevance and novelty of this research illustrated by the fact that there were few text available on which to base this investigation. Therefore where literature specific to the subject area was available, the contributions were broadly synthesised to inform and develop the study. To summarise what the review was able to glean from current literature relating to the sector, is that;

- Current text published relative to the subject area tends to be directed at the retail and market sector, which is seen to be the successful and profitable element of the industry.

- That the role for the consumer within the sector is far more dominant than in comparatively recent years which have had significant impact on industry processes and practices.
- Documentation outlining government agency practice illustrate that they are in place to aid the sector.

The sources accessed to gain insight into current industry specific technology suggest;

- There are few sources that outline currently available technologies.
- There are a multitude of diverse technology types that offer varying types of facility and functionality.
- That the developmental technologies are available that could offer opportunities and enhancement of industry practice in the future.

Reflecting on the process of identification of the literature and contextual matter, and the difficulties encountered due to the limited source data, suggests that the clothing sector is a subject area that would benefit from further investigation and study.

Chapter 3 Research design and methodology

3.1 Introduction

This chapter outlines the methodology adopted within this programme of research, and the context in which they were selected. The requirement of the methodology chapter is to consider;

- the system of methods and principles used in a particular activity
- the study of method and procedure

(Robinson & Davidson, 1996)

The data collection undertaken has three areas of focus within the clothing industry sector, and a hybrid research method was required to elicit knowledge from MSME businesses, technology providers and high street retailers. Contrasting and complimenting methods were required to obtain valuable insights into each sector. The method of data collection evolved heuristically, applying existing knowledge to devise a hybrid approach to bring together different traditions of research in one study (Robson, 2002).

The study involved gaining individuals opinions on current industry practice, through completion of preparatory exercises and questionnaires devised to compile a series of underlying quantitative results. This base level information formed the groundings for further, more detailed enquiry later in the study, with subsequent stages involving interviews and focus group sessions. Transcriptions generated were qualitatively analysed, in a way that incorporated the facility to relate and contrast the data compiled from individual interviews and group discussions.

Overall, the findings obtained offered opinions from interconnected, yet diverse industry sectors. Analysis enabled theories to develop to gain further understanding of the interrelationships existing between sectors and the level to which technology is currently available and utilised within the clothing sector.

Grounded theory was the approach implemented to consolidate and summarise the findings from each research element, due to the nature of the subject being 'novel' with pre-existing theories being limited (Robson, 2002). The basis of the theory

development and formulation (Hart, 2003, pp 83) within this investigation builds upon the application of previous industrial experience.

3.1.1 Selection of research methods

For each research element a number of options were considered as approaches to data collection, table 3-1 below outlines what was considered, selected and the rationale behind the choice.

Table 3-1 Selection of research method for each element

	Considered	Selected	Rationale
E1	1. Questionnaire 2. Knowledge elicitation	2.	Allowed incorporation of developmental research methods, eliciting knowledge through language and visual representations
	1. Focus group – homogenous 2. Focus group - heterogeneous	1.	Bringing together individuals with a common interest to discuss industry practice
E2	1. Direct 2. Indirect	1.	Due to the questionnaire being implemented within a trade fair environment, a direct approach was required
E3	1. Formal questionnaire 2. Semi-structured questionnaire	2.	A semi-structured questionnaire was used to encourage respondent to expand on their response
	1. Un-structured 2. Semi-structured 3. Structured	2.	A semi-structured interview was used to maximise the level of information elicited
Sum.	1. Focus group 2. Interview	2.	An interview was opted for as a more in-depth discussion was thought to be required

3.1.2 Research design aspects

Identification of a methodology appropriate to the research subject was key to the success of the study. Due to the newness of research within the field of Design the use of developmental techniques to investigate complex, practical situations are more commonplace.

The process of methodology selection incorporated consideration of relevant literature (Jayaratna, 1994; Bernard, 2000; Greenfield, 2002; Robson, 2002), also how PhD research in similar fields undertaken was undertaken (West, 1993; Lowson, 1999; Shina, 2000; Apeagyei, Otieno & Tyler, 2007), this review combined with personal experience of research approaches informed the decision. Whilst completing an earlier

research project for an MSc course, also within the clothing sector, a formal, structured questionnaire had been used to obtain data. As the principal form of data collection the results were limited to the questions that were asked, this approach produced analysable results, however was restrictive in terms of the potential to build on areas of interest and gain additional insight. Therefore the researcher strove to identify a way in which to generate initial findings that could be built upon during subsequent stages of the research.

The selection of a combination of preparatory exercises and discursive elements reflects the requirements of the subject area, tailoring existing approaches to achieve a new form of results. For the purpose of this research an initial developmental exercise was combined with subsequent more structured stages, allowing resultant data to be qualitatively analysed. This approach enabled opinions both from individuals and groups to be obtained and considered.

3.1.3 Visualising the clothing process diagrammatically

The most developmental research component within this study was the use of a process modelling technique. This approach evolved through the observation of subject related authors' visual approach to process representation. Consideration of the different approaches to visualisation led to the creation of a conceptual model by the researcher at an early stage of the research that represented her personal understanding of the different processes within the sector, this can be seen below in figure 3-5. The additional purpose of the model is to articulate how the industry components (design, manufacture, market and technology) interconnect, and provided an effective way to express understanding of interrelationships. This term derives from the verb interrelate, which is defined as;

- to be in or be brought into a mutually dependent or reciprocal agreement

(Robinson & Davidson, 1996)

Within this section similar process mapping undertakings relative to the sector have been compiled in order to illustrate the different approaches and interpretations that are made, linear, random, and cyclic. Understanding the content and perceived messages given from each of the diagrams will enable an accurate representation, which is simple to translate to be created for the purpose of this research.

The diagram below in figure 3-1 was located in an article by Hines (2000) and is an interpretation compiled using cognitive mapping techniques within a clothing organisation to visualise their management decisions. This example was used over the maps shown in the article by Tyler (2001), due to the format and the increased impression of complexity illustrate in this model. Viewing and eliciting meaning from the diagram is complex, due to the randomness of the identified elements and prevalent influencing factors, where no indication is given of the process it represents. Connections between the different elements complicate the diagram further, as they distort the understanding further through their randomness. This arbitrary impression reaffirms that there is no flow or order to this interpretation which does not offer the simplicity required for this study.

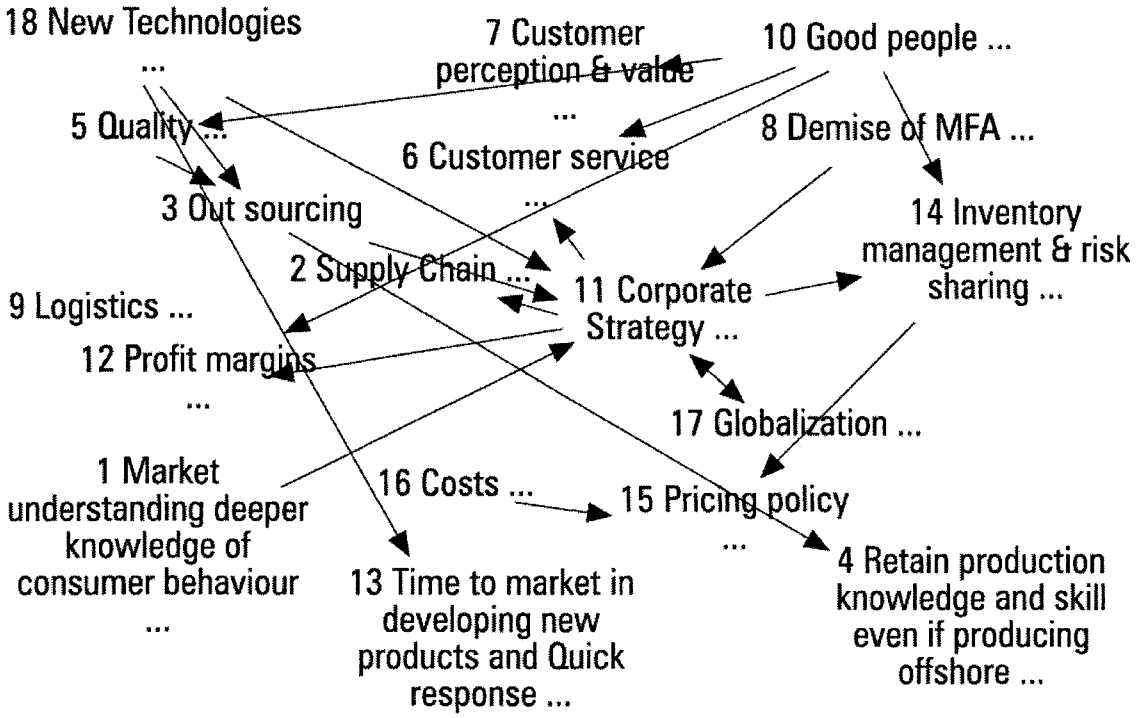


Figure 3-1 Cognitive map produced by managers in a small clothing manufacturer

The next diagram, figure 3-2 provides a simplistic flowchart devised by McKelvey and Munslow (2003) purely to outline the fashion design process. The diagram offered a linear representation of the process, incorporating stages from analysis of the brief to selection and promotion of the product range. The components have been developed to include subsections also associated with the process. The format of this diagram infers that there is a beginning and an end to a sequential process that does not incorporate any opportunity of feedback or reflection. This approach relates more to

the understanding of a process undertaken to create a product, however further detail could be added through the integration of feedback loops.

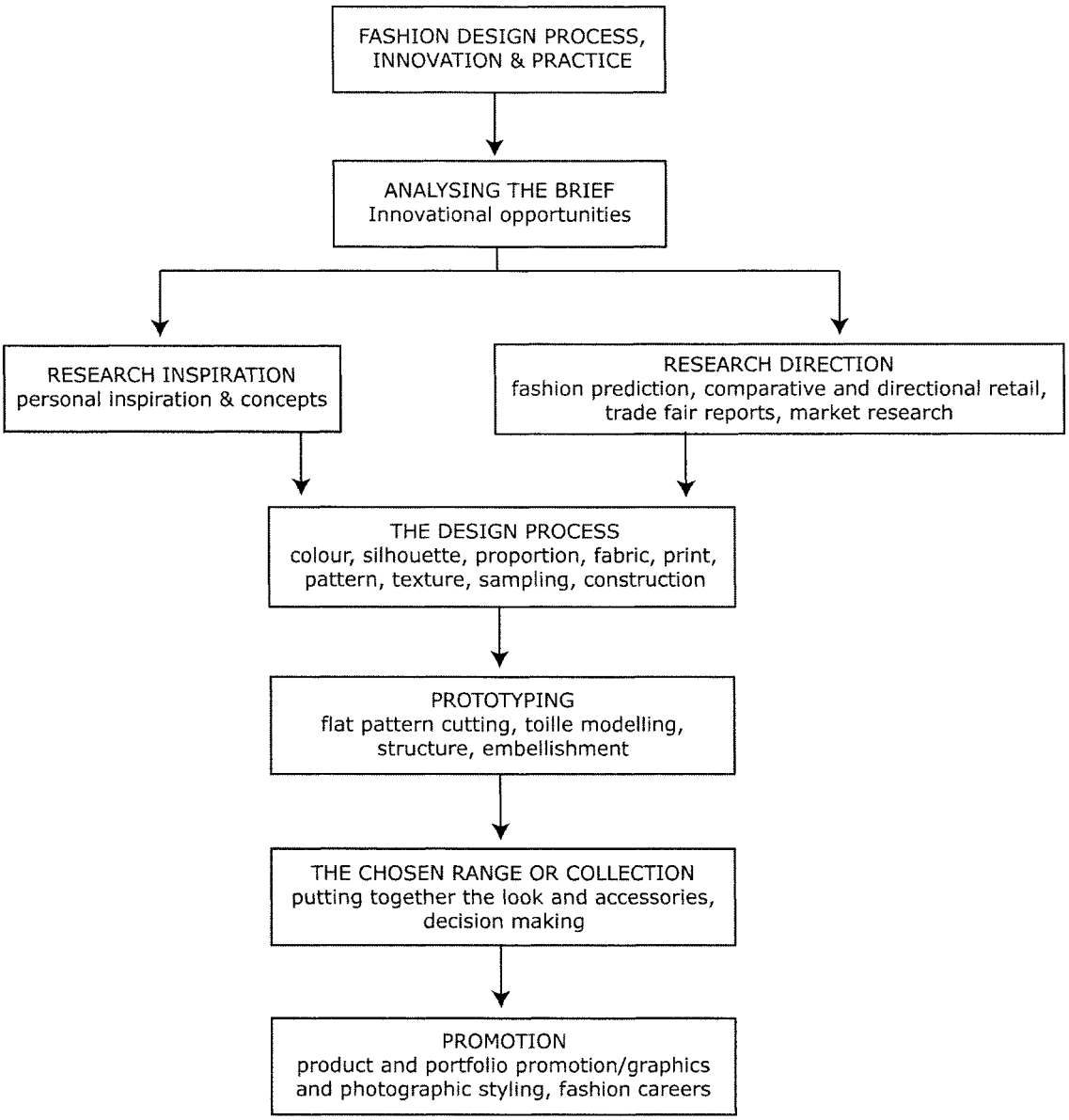


Figure 3-2 Simple flowchart to explain the design process

The diagram devised by Jones (2002), see below in figure 3-3, shows a detailed and fairly complex interpretation of the industry processes, considering aspects from the selection of fibres through to final consumption of the apparel goods. The appearance of the diagram looks to be relatively straightforward, however the content incorporates many stages indicated by the 'levels' to the right that add further complexity, as the distinction between each level is difficult to identify. Accompanying this diagram is

almost a page of text with appropriate descriptions, suggesting that it is too detailed to be shown in a simplified way.

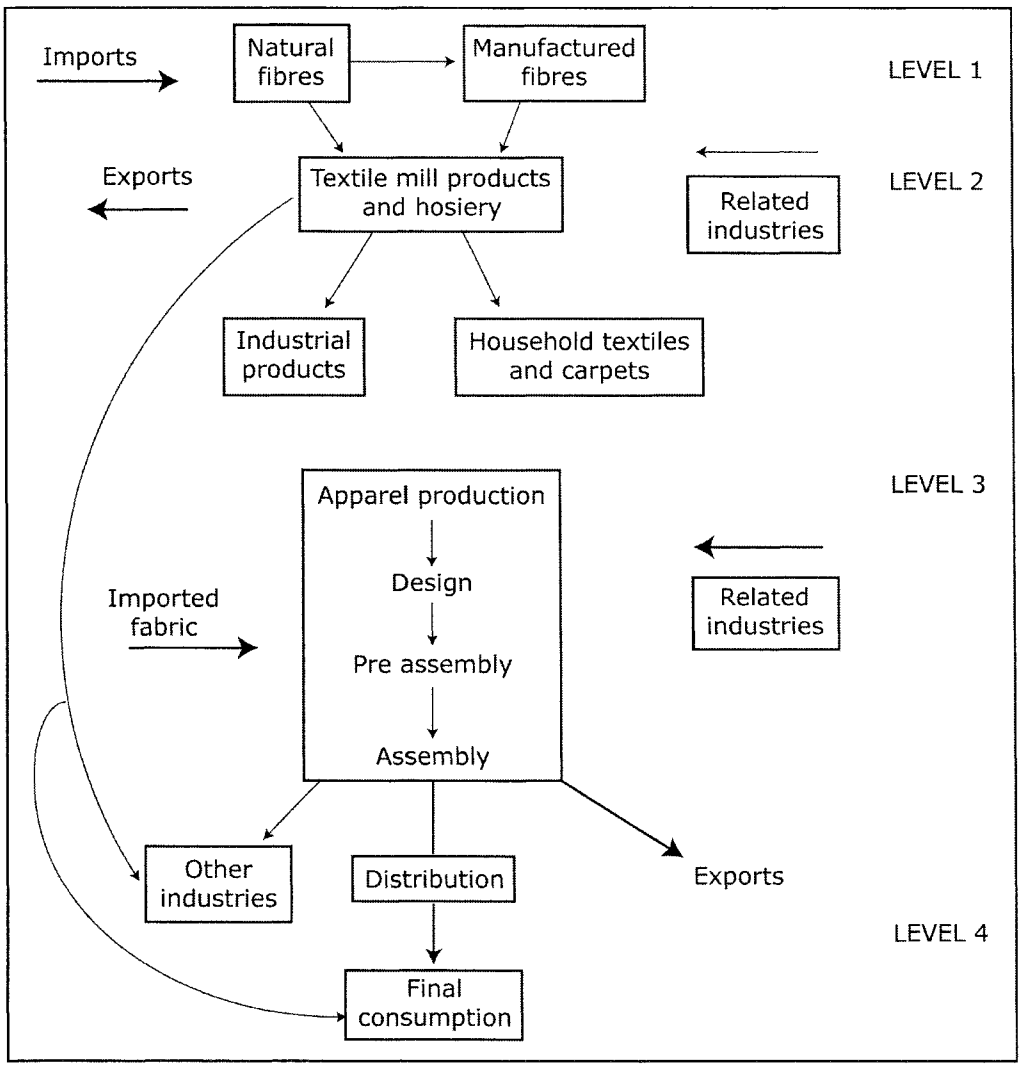


Figure 3-3 The textile – apparel pipeline

The clothing commodity chain devised by Hassler (2003) shown below in figure 3-4, offers an interpretation of the clothing process that is very complex, and therefore difficult to understand. The diagram is formed into zones or subsections that are enclosed by dashed line boxes, which are not easy to decipher. The connections between the subsections are single or multidirectional, using a combination of solid and dashed lines with arrows added to illustrate the direction and relationships. There is no apparent order to the process, but incorporates stages from design to retail. This depiction of the process offers an overly detailed and therefore complex representation of industry practice.

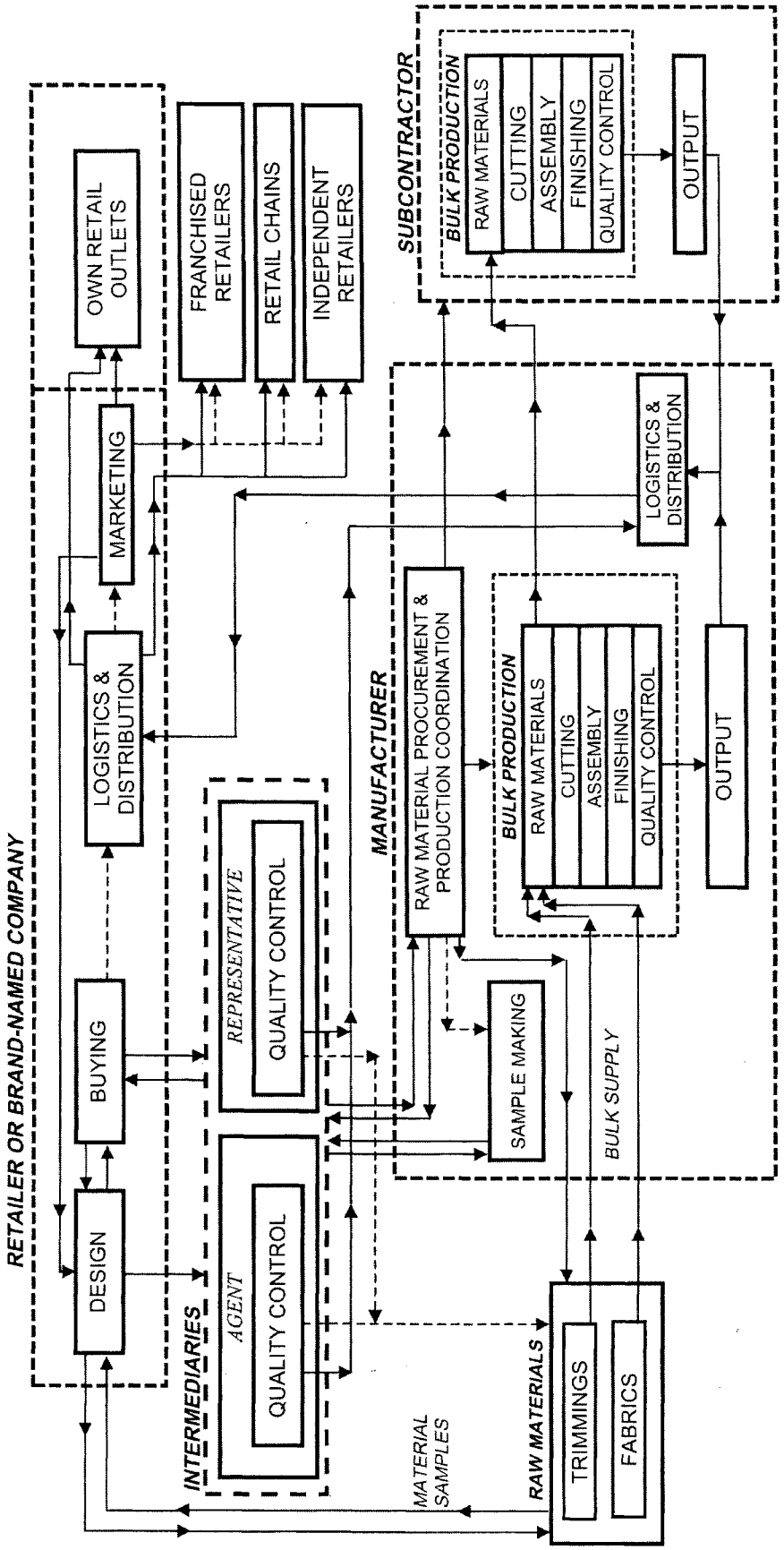


Figure 3-4 A clothing commodity chain: retailer brand and brand name company

The diagram below (figure 3-5) was created to illustrate the focus of this research programme. The content of the diagram was formulated by the researcher to visualise the perceived processes occurring within the clothing industry; the flow of information, interaction with technology, the movement of garments and also the relative data. It was generated to represent understanding of the connections between each of the industry sectors. Whilst devising this process diagram, it was considered relevant to show the constant flow of information, but also the influences each sector has on the other. There is no significance intended by the size of the components, they are purely in place to illustrate the product and information flow.

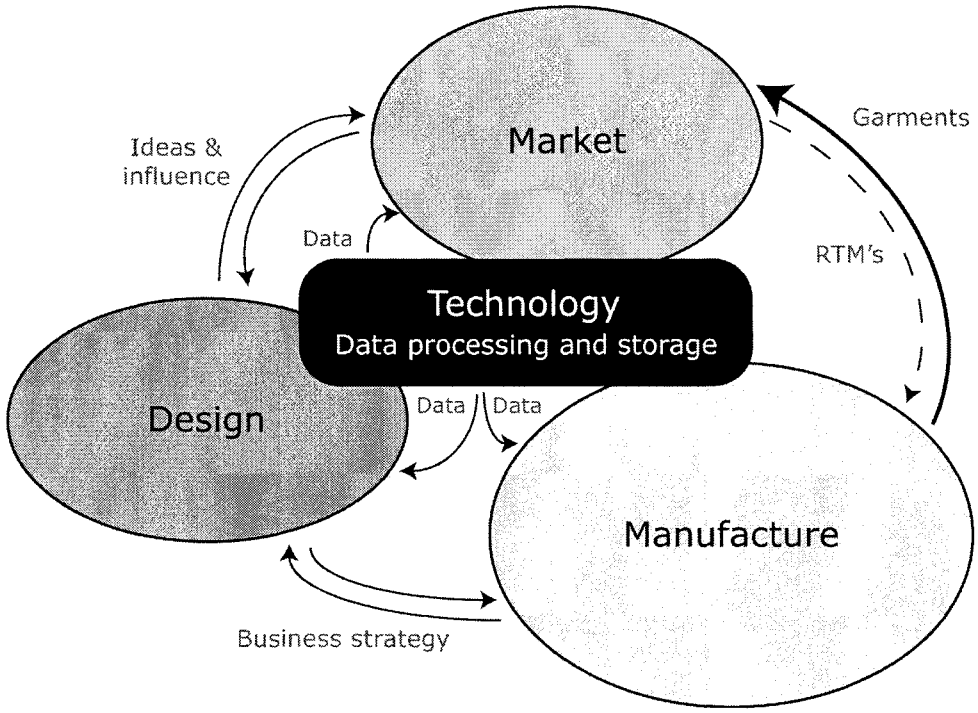


Figure 3-5 Conceptual map of industry process

During this stage in which comparative approaches were considered, no process map was identified that illustrated the relationships and processes that occurred between fashion/design practice and the practicalities of translating the designs into garments suitable for manufacture. A diagram was created by the researcher to illustrate how these key aspects of industry are required to interact to create marketable products. This can be seen below in figure 3-6.

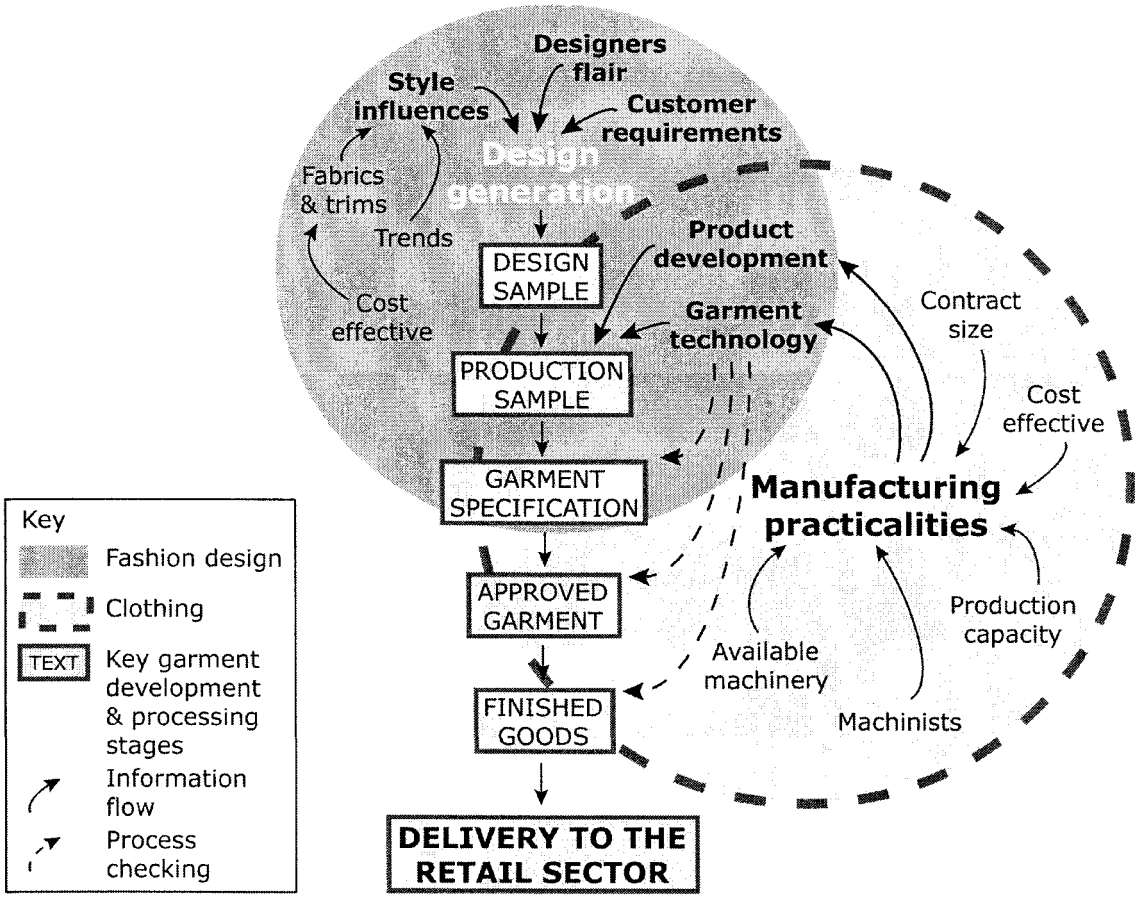


Figure 3-6 Interrelationships between fashion/design and clothing manufacture

The use of diagrams provided opportunity to further understand the diverse ways in which the clothing industry process can be articulated. As part of the research programme they provided the basis for a novel approach to extract tacit understanding from respondents. Within the data collection, diagrams were generated using the developmental knowledge elicitation approach, subsequently forming the starting point of discussion within the more conventional focus group environment. Treated as snapshots of knowledge, the diagrams were compared within homogenous groups on a sector specific basis in order that members identify the visual impression that was most representative of processes undertaken.

To maximise the information obtained, firstly the respondents were asked to show in a visual form how they perceived the relationships within their market sector, and secondly how they considered the industry in its entirety to exist. The output of the exercise provided a series of sector specific, comparable process maps illustrating the varying levels of comprehension of industry interdepartmental relationships and practice, which can be viewed in appendix 6 and 7. The use of the diagrammatic

element avoided use of an alternative detailed and lengthy questionnaire. This interactive method incorporated an opportunity to gain an insight into practitioners' opinions on internal processes, industry relationships and gain further understanding of industry practice in a creative way.

3.1.4 Approach to data collection

The complex nature a research programme compiling opinions from three different industry sectors required an integration of multiple methods in order that accurate insights were gained into each. Three sectors were targeted in order to gain a strong contextual breadth within the clothing industry: the NE regional MSME businesses, national high street retail sector and the national and international industry technology providers. Understanding regional business practice was a priority within the study, therefore it was imperative that a broad sample of data was obtained. The required insight was gained using a process of knowledge elicitation, the findings from which were discussed within homogenous focus groups to elicit and evaluate the practitioners' inherent tacit knowledge. The use of a structured multiple approach, ensured that each of the three main elements investigated were fully considered. This interdisciplinary approach identified a number of challenges;

- To ensure terminology used was appropriate for each sector
- Consider any knowledge boundaries that might exist
- Adopt a systematic and systemic approach to the data collection

Further consideration of these issues highlights the need to fully understand the reasoning behind the approach to this subject area. Experience of industry practice prompted the focus on the identification of currently used terminologies within the sector. The relevance of identifying terminology use relates to the importance of terms and phrases elicited during the data collection as it was considered important to identify any universals (Comrie, 1981; Clegg *et al.*, 1999) that exist, and were commonly used, suggesting a collective meaning and understanding within and across the sector. This element of the study was originally devised as a means to identify and acknowledge the terms being used. However, as the study progressed it became apparent that this approach offered far more insight than originally anticipated. Gaining insight into knowledge boundaries in terms of industry practice is undertaken through the completion of the process diagrams (McKim, 1980; Root-Bernstein, 2000) provided an insight into the levels of understanding of tasks involved in the different sectors of the

industry. In order that these elements of the research were effectively undertaken, a logical approach was required to ensure each aspect was sufficiently considered. The following pages outline how each research element and phases of data collection were formulated in order that the knowledge compiled at initial stages could be readdressed further within later research stages. Text abbreviations have been used to aid understanding: E refers to Element, P refers to Phase. The three research elements were structured as shown in table 3-2 below;

Table 3-2 Structure of research elements

E1 Regional MSME sector analysis
E1 P1 – is a preparatory exercise devised to generate base level findings which can be considered further within E1 P2. E1 P2 – conducting three homogenous focus group sessions in which the findings from E1 P1 can be discussed by sector (design, manufacture, market).
E2 to understand national and international industry technology suppliers
E2 P1 – a short questionnaire devised to gain specific product information within a trade show environment.
E3 analyse IT usage within the high street retail sector
E3 P1 – a preparatory questionnaire formulated to identify discussion points for the following semi structured interview. E3 P2 – a semi structured interview in which companies representing the high street retail sector discussed aspects relating to industry specific technology use.
Summative interview
Final data collection phase where findings from all subsequent phases were discussed.

The data collection was undertaken over an 18 month period, however the processes did not occur in sequential order, therefore figure 3-7 was created to provide a visual timeline outlining the order of data collection processes.

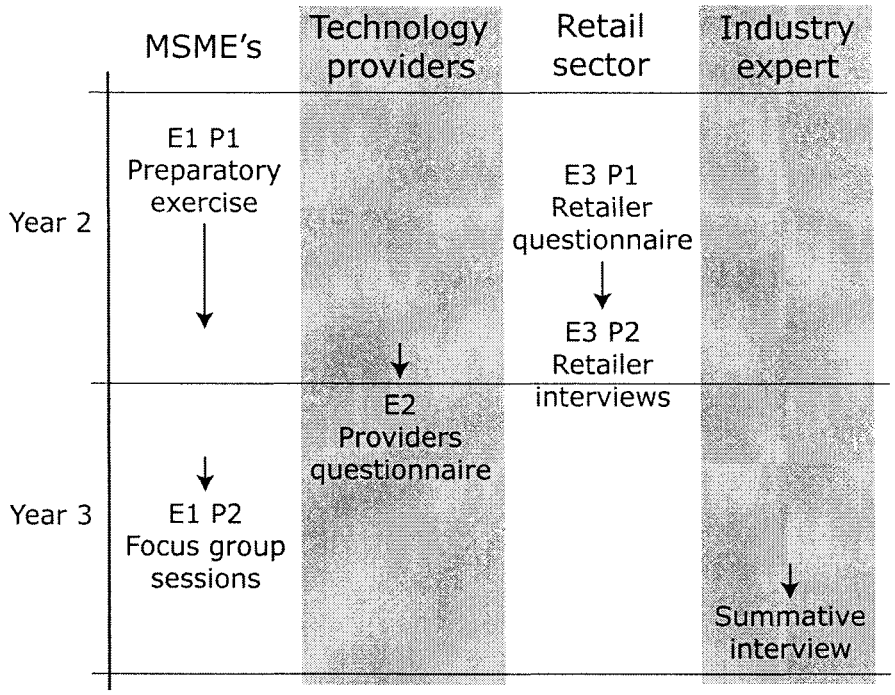


Figure 3-7 Timeline of data collection process

Figure 3-8 has also been incorporated to show in more detail the process of consolidation of the research findings, this diagram can also be considered as an indication of the conceptual framework on which the research programme is based.

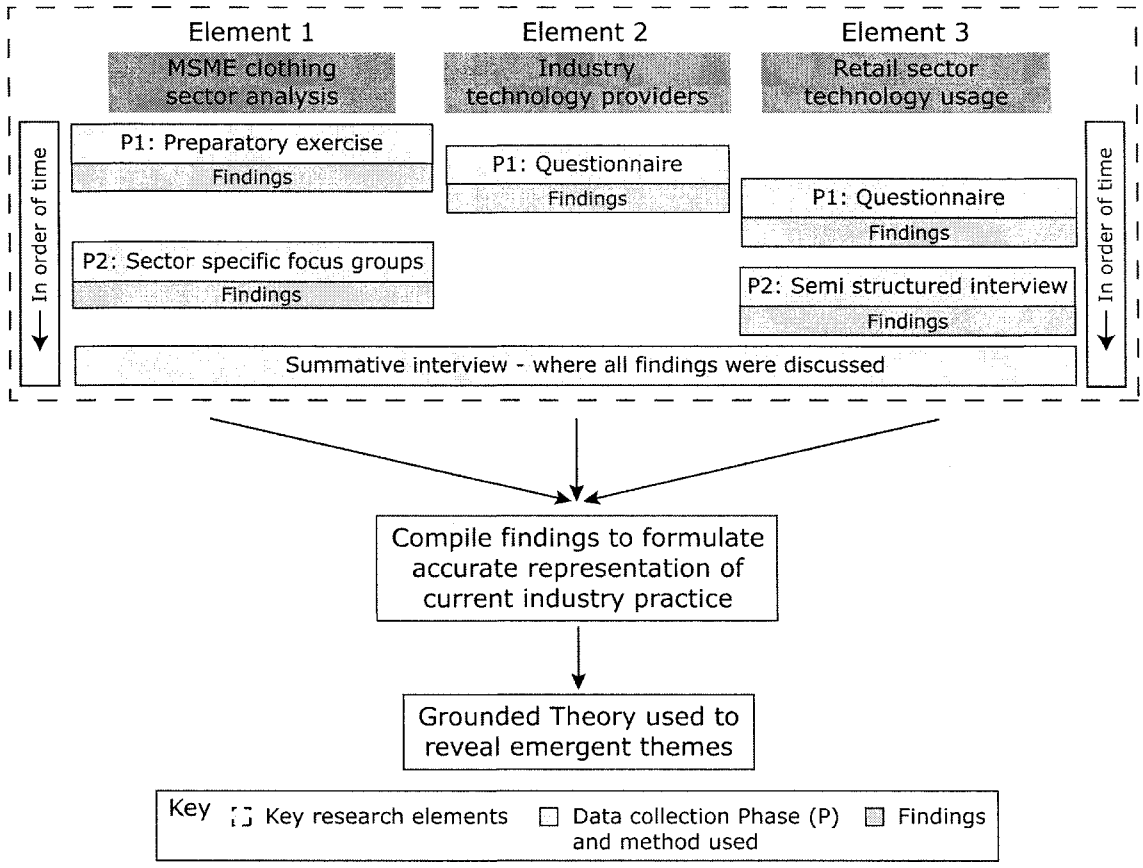


Figure 3-8 Consolidation of research elements

By understanding the order of progression of the research process, it has shown how relevant findings from each phase influenced the content or application of subsequent phases. This reflective approach ensured that where relevant, subjects were iteratively considered at a number of levels.

The principal element of the data collection focused on the NE MSME clothing industry, from which it was anticipated that the majority of the knowledge held within the sector would be of a subjective tacit nature. Considering this, the mode of data collection using a combination of preparatory exercises and focus group interviews enabled respondents to more easily externalise this knowledge. The secondary element of the research involved conducting a short questionnaire with a number of industry technology providers. The final element considered the high street retail sector, in which preliminary questionnaires were distributed and completed prior to conducting a semi structured interview. In order that the data collected through each approach was effectively utilised, the data was analysed, brought together and discussed as findings within a summative interview.

In instances where questionnaires were distributed electronically, or made available through the Centre for Design Research (CfDR) website (the industry technology suppliers and retailer questionnaires), they were accompanied by a document explaining the rationale behind the particular element of research programme, these can be seen in appendix 4. This ensured respondents had access to a document outlining of the content and context of the research.

3.1.5 Analysis of data

To complement the method of data collection, appropriate analysis techniques had to be considered. The research programme incorporated a combination of methods, with outcomes at different stages, were in different forms, therefore suitable process of analysis was applied which are explained in order of completion;

E1 P1 – This preparatory exercise incorporated two elements; first a series of word lists personalised by the respondent, these lists were compiled and entered into a profile matrix (Bernard, 2000) within an Excel spreadsheet, allowing the measurement of relations between items; second was the developmental process mapping element (outlined in section 3.1.1) in which the diagrams created were considered as individual accounts (Entwhistle, 2006). For use in subsequent stages of the research the hand drawn diagrams were directly translated into a vector based drawing program, allowing easier more effective use within later research stages and the final thesis.

E2 P1 – The data from these brief questionnaires was compiled as with the word lists, and entered onto a profile matrix within Excel so that the findings could be easily viewed and trends identified.

E3 P1 - The data compiled from the questionnaires was compiled and tabulated within a spreadsheet to allow comparison, and enable questions to be formulated for the semi-structured interviews. Again, in order to view the findings effectively the data collected was translated onto a profile matrix.

E3 P2 – As this element of the research had been incorporated in order to contextualise technology use across the clothing sector, a partial transcription (Bird, 2005) approach was opted for, this summary document was a collation of the five interviews generated from notes taken from digital recordings. The notes were

compiled on a master document for analysis within a qualitative analysis software package.

E1 P2 – Full transcriptions of the three sector specific focus group sessions were made for final analysis.

Summative interview – a full transcription was made of this one-to-one interview to give an overall view of the research findings.

As outlined above, a number of methods of analysis were utilised for different phases of the research. During the early stages of the research programme, an SPSS training course was completed, however, due to the limited incorporation of quantitative data being compiled that level of statistical analysis was not required. For the analysis of the underlying data, spreadsheets were used primarily due to the versatility of function for data interpretation. The 'count' function was found to be a valuable tool to indicate frequency, also numerical values were applied to standardised responses, such as Yes = 1, No = 2, No response = 0, giving trend information at a glance. The additional benefit of spreadsheet use is that all the data from a number of questionnaires to be stored in one document.

As a significant element of the research output, identification of suitable approaches to analyse the transcription data was vital. Using a software package was recommended early on in the programme. It became apparent that there was a principal provider of this type of technology QSR[6] (2007) offering a choice of two packages NU*DIST and NVivo. It transpired that experience of both was available through a single training session, as both worked using similar principles. The main difference was the interface and ultimately the ease of use. Two research colleagues had used the NU*DIST and a third had used NVivo, after an initial investigation and a number of conversations regarding ease of use relating to document preparation and analysis influenced the decision to use NVivo.

6 QSR provides qualitative data analysis products to analyse text or transcribed aural based findings and are different to statistical or quantitative software, which analyze numerical datasets.

3.2 Research considerations

This programme of research was devised to gain an insight and understanding of the current clothing and fashion sector processes and practices. As the study evolved, the ethnographic nature became increasingly apparent due to the importance of appreciating the patterns of knowledge shared by the respondent groups (Ford & Sterman, 1997). In order or fully understand industry practices, the need to gain an insight into each respondents tacit knowledge was vital. Therefore appropriate way to elicit the required information was carefully considered and a developmental/hybrid knowledge elicitation approach was devised.

As the results of this programme of research were being obtained and compiled, a discussion took place with a practicing sociologist conducting research in the field of fashion design (Entwhistle, 2006). The suggestion was made that the diagrammatic element of the initial data collection exercise, which was identified as a 'textual window of reality', should be appropriately considered.

3.2.1 Importance of conferences and trade fairs

Attending conferences and industry trade fairs was an element of the research programme that added significant breadth to the researchers' knowledge base. The benefits were not only in the practical and developmental knowledge obtained, but also through the invaluable network of contacts established. There is also the factor that the subject areas covered within the different event supplemented areas that literature may not cover.

The academic style conferences in the UK aimed specifically at the clothing and fashion sector tend to be linked to either to London College of Fashion or the Textile Institute. However, as the research conducted had influences from a number of fields, attendance of conferences were not limited to those aimed at the sector. For instance, during the early stages of the research, when the focus was application of digital bodyscan data, the researcher attended an Ergonomics Society (2003) conference in which invaluable contact was made with Phillip Treleaven and Andrew Crawford, both critically influential in the development of 3D body scanning. Another example was a Design Council conference conducted in the North East to encourage innovation within regional MSME's. A list of all the conferences attended can be viewed in appendix 1.

In addition to the academic events, attending Europe's largest clothing industry trade fair IMB2006 (2006) in Cologne provided the opportunity to approach the technology providers whose products formed the basis of this study. In addition to the trade stands additional events were also incorporated to offer further value to those attending. There was a one day plenary session organised by the European clothing sector research body LEAPFROG, this was included to outline the developmental projects being undertaken within the sector across the EU. Also, at the centre of Hall 8 (see the map illustrated in figure 3-10), which was dedicated to technology, the yearly IMB Forum 2006 entitled 'Information Technology' took place throughout the second day. The forum was promoted as a special interest event that provided an environment in which suppliers and buyers discussed current and innovative topics relating to the field. Attending the presentations given by the leading market providers in the field offered an insight into their product capabilities

Reflecting on all of the conferences attended throughout the duration of this study, it became apparent that certain groups tended to attend certain events. It became apparent that attending these events provided opportunity for these groups to interact, find out new information, discuss positive and negative issues all relative to the subject area of the conference. Having attended this type of event prior to undertaking the study, it was noted that a community atmosphere was apparent, this is due to the target audience of conference or event attended (trade or academic), being a fairly exclusive group. The term community in this instance is being used to refer to a concept similar to the 'periodic clusters' outlined by Maskell and Lorenzen (2004) in which there is an interest in: the knowledge creation effects of agglomerate behaviour; the way in which the knowledge flows within these environments; and the consideration of the organisational context of learning and interaction. An observation was made that within the current industry environment, due to recent shifts in sector status, businesses within the clothing sector currently have few opportunities to meet with like-minded colleagues. In recent years when the clothing sector still had a relatively strong presence in the UK, a number of national trade events were held across the country; London, Birmingham, Harrogate. These events provided opportunities to meet suppliers and colleagues in an environment that was conducive to interaction and development.

The interest in the perceived benefits of trade fairs led to the article by Maskell *et al.* (2004) in which the rationale behind the necessity of such events are outlined. This paper identifies many key issues associated with trade fairs that are considered to be

positive. They see the fairs as being 'short lived, often periodical events for the exchange of commodities, information and ideas' (Maskell, Bathelt & Malmberg, 2004) in which likeminded people come together. Identification of the benefits associated with this 'trade fair community' brings attention to an area that is lacking within the current industry culture. Currently the level of inter-organisational interaction is very limited with companies rarely communicating with business counterparts, which is a situation that could ultimately affect the future development of sector.

3.2.2 Developmental methods devised to understand industry

This exploratory study comprised of many components and variables, such as interaction with industry representatives across the sector, as well as the different methodologies implemented to elicit the information. In order to accommodate this complexity, a heuristic approach was utilised;

- Encouraging learners to find their own solution
- Adopts a method of trial and error to solve a problem

(Robinson & Davidson, 1996)

This approach ensured there was an element of flexibility in the way data collection was undertaken, in order to adapt appropriately in order to maximise the potential outcomes. Whilst conducting the preparatory exercise in element 1 (E1), phase 1 (P1) which used a developmental approach this principle was tested. An innovative approach was sought to obtain an insight into industry processes and practices from an industry practitioner's point of view using an emailed questionnaire that was to be returned. When it was apparent that this was unsuccessful, the approach was altered to a one-to-one interview style implementation, which ensured industry representatives could allocate the time required to complete the exercise (Robson, 2002). Once it became apparent that the revised approach was more effective, each of the other participants were contacted so that their exercises could also be conducted in the same way.

One of the principal objectives for this research programme was to gain an insight into industry practice, and after having studied the industry in a previous Master of Science project, the researcher wanted to approach the subject in a more innovative way. Initial investigation identified that accessing the tacit knowledge inherent within the sector would give the most insightful understanding of the social context (Gertler, 2003) that

exists within the sector. In order to effectively elicit the required tacit knowledge held by individuals within clothing organisations, a developmental approach to knowledge elicitation[7] (McNeese *et al.*, 1995) was devised for this purpose. The exercise in E1 P1 was devised for this purpose, and was comprised of two stages, firstly personalising a series of word lists, the second the creation of two process diagrams that represented their understanding to their role (Cook & Brown, 1999). The concept was relatively straightforward, and even if the respondent was unfamiliar with the process map concept, the instructions and the blank space gave a clear indication of the requirement.

There is also the element of transferability related to the developmental research methods used within the programme. Within an industry environment it is difficult to extract and elicit the tacit knowledge that exists within a workforce relative to a specialist area. This research process could potentially form the basis of a system of obtaining, considering and developing inherent workforce knowledge that would encourage involvement during the interactive data collection processes. The processes to extract information were developed specifically to identify clothing industry process. However this format of approach could be applied to any industry or business situation. The approach was devised to encourage respondents to think about their own position in terms of the wider context (Gertler, 2003), therefore introducing opportunities for development and potential change in practice to occur from within.

3.3 Identification of respondent groups

The research programme required a thorough overview and understanding of the current clothing sector, therefore representative areas of the industry were identified as populations for investigation. Each element required the logical identification of potential respondents within each target area. Three sectors of the industry had been identified to contextualise the research findings: regional MSME's, technology providers, retail sector, therefore an illustrative sample group was identified using the processes outlined below to ensure that a representative view point was obtained. A principal requirement of the research was to obtain opinions from industry practitioners, therefore it was considered necessary to gain the opinions of senior level employees,

[7] The term *knowledge elicitation* is most strongly associated with the development of *expert-* or *knowledge-based systems* (McNeese, 1995)

or where possible company owners to ensure the reliability of the data and validity and merit of findings.

As different aspects of the industry were being studied, appropriate forms of selection were required to gain a valid insight. This section will outline the various approaches adopted during the study to identify potential respondents in the regional MSME, technology providers and high street retail sector.

3.3.1 Regional MSME clothing sector

Gaining an insight into existing interrelationships on a regional level was a formative component of the research programme. Therefore in order to achieve an accurate understanding of the current regional clothing industry through E1 of the research, it was necessary to identify appropriate sample groups for the data collection phase. To gain representative opinions, identification of companies across the three industry sectors within the North East (NE) region was aided by company information obtained through the NE branch of Skillfast-UK. Permission was granted to access a comprehensive list of businesses registered to the clothing sector within the geographical boundaries of the region, previously outlined in figure 2-3. The process of selection to identify businesses to approach was based on their involvement with the three processes; design, manufacture and market, identified in the sector model shown below (figure 3-9). For the purpose of this research programme four or five organisations per sector were identified from the region wide list. Those businesses involved in the study are outlined in table 3-3 below, where it shows also how a number of the companies were used in more than one sector. Companies were primarily selected for the study due to their regional status, and could also be identified as having links to the design, manufacture or market processes. The variety of companies selected ensured that representative perceptions of the industry were obtained.

Table 3-3 Regional MSME businesses involved in this study

Design	Manufacture	Market	Other
Airowear Cameron-Addison Allcord Berghaus Nigel Cabourn Penny Plain Visage	Airowear Barbour Crampton Dewhirst Corporate Clothing	Barbour Crampton Officers Club Penny Plain Sadie the Bra Lady Impressions Retail	B Supplied

As the purpose of research phase E1 was to consider the existing interrelationships between the industry sectors, companies dealing with design, manufacture and market were approached. Within and across all sectors there exists a complex series of interrelationships, suggesting that although as an industry there is ultimately the common goal of creating garments to be sold, there are many levels at which this occurs. Therefore within each sector, companies have their own role in the process, for example: Cut, Make and Trim (CMT); large scale mass production; low capacity MSME manufacture; sole trader or chains of retail units. This inherently disparate nature reflects the different types of business which can be located in any area, therefore it was considered appropriate to identify a range of businesses with varying functions.

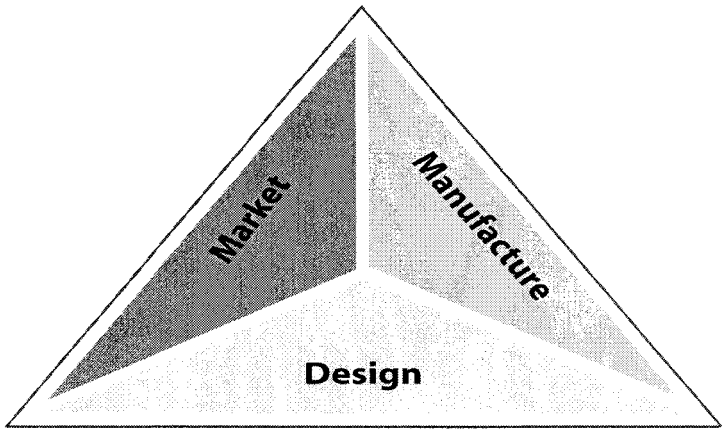


Figure 3-9 Clothing industry sector model

For research stage E1 P1, the preparatory exercise, identification of key personnel within each organisation was also required in order to generate a requisite and accurate overview of the current sector. In order that the data collected could be considered representative those approached were at a senior level, management or above. Within the micro and small businesses, it is common for individuals to work across functions within the workplace, and they are therefore able to give an informed insight into one or more of the sectors. Larger organisations tend to have internal departments that are representative of the sector model in figure 3-9, therefore more than one person within that company would be approached. Allowing flexibility in the respondent selection process ensured that the maximum number of participants would be identified.

The approach for E1 P2 was to invite the respondents involved in E1 P1 to partake in the sector specific focus group sessions, in order that the findings obtained during P1 could be discussed further. The homogenous nature of the sessions was key to maximising results, as the discussions will benefit from participants knowledge about the topic (Langford & McDonagh, 2003). The approach of utilising solely the respondents from P1 was reconsidered during the session planning phase as significant difficulties arose when arranging suitably sized focus groups. The low initial response rates from those invited to attend from the previous phase resulted in the researcher having to identify additional potential participants. The content of the session was not affected as it had been devised to be anonymous. Therefore those participants not involved in P1 were not disadvantaged in any way.

Each of the three sessions required attendance of groups where possible to be secured prior to the event, however as this relied on external parties to attend needed all possible eventualities were considered. The first session was held at the CfDR, in which the design sector practices were discussed. Although prior to the event four participants had confirmed attendance, two were unable to attend. As a contingency, two reserve candidates that were academic members of staff that had recently joined the university from the fashion sector were in place as potential participants. The second and third sessions were arranged to run in line with a regional event run by Skillfast-UK in which an established network of representatives from regional businesses were invited to attend. The rationale behind the decision was that there would be an increased likelihood that the MSME businesses would attend an event that they could they potentially benefit from. By running the sessions alongside the event, those attending who had not been aware of the session were also invited to participate, and as it was a clothing sector event potential participants would have prior knowledge of the subject. Interestingly, in this instance there had been initial concerns that there would be low numbers likely to attend the group to discuss the manufacturing sector, the reality however, was that the manufacturing sector attracted the largest number of participants out of all the groups. Securing attendance for the focus group sessions required time, determination, persistence and the importance of incorporating a contingency plan was essential to the implementation of the sessions.

3.3.2 Industry technology suppliers

The second area of focus of this research programme was to investigate the technology available within the clothing industry sector. As the research was reliant on

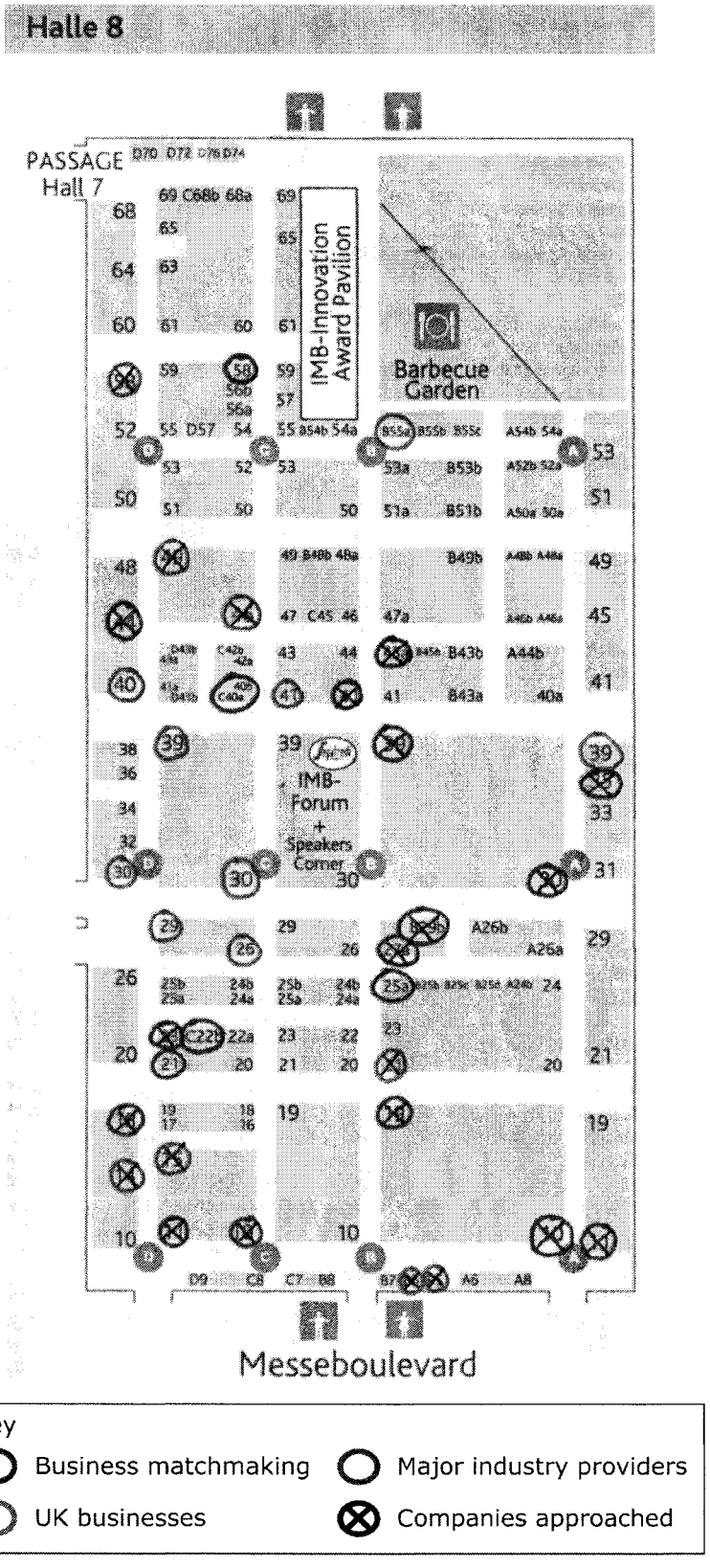
the awareness of current and developmental technologies, the opportunity availed to attend IMB 2006, the tri-annual clothing industry trade fair held in Cologne, attendance of which was considered to be vital. IMB is the largest clothing industry trade fair in Europe offering the perfect chance to discover first hand the products and services currently available. In order that maximum gains were achieved through the visit, a realistic proportion of the 160+ technology-related businesses exhibiting were identified. The trade fair website offered a business matchmaking facility, which automatically generated a list of potential stands relating to the users defined area of interest which initiated an expression of interest on the researcher's behalf. The benefit of using this system is that the companies that are contacted are given the option to respond, often with a personal invitation to their stand with a contacts name, which is always beneficial in a trade fair environment. In addition, a standalone comprehensive list of companies with stands at the show was available as a download from the website, enabling further specific businesses from the UK that were showing at the event to be identified. The final influencing factor of the pre-visit planning was identification and inclusion of the major industry service providers. Below, table 3-4 outlines the companies involved in this study.

Table 3-4 International technology providers involved in the study

Alva products	Lectra
Blackman & White	Microsoft
Blue Fox Ned Graphics	Optitex
E-Measurement solutions	Option Systems
GenCom	PTC
Gerber Technology	Pebblestone
Human Solutions	Telmat Industrie
Infor	Visual retailing
Koppermann	

Having attended trade fairs prior to embarking on the PhD research programme, it became apparent that a strategic approach was required to gain the most from the event, which reflects the approach outlined by Gryskiewicz (1999). Therefore, the map shown below in figure 3-10 shows the process by which companies within the 17,000 square metre hall could be identified. The organisations to be approached were prioritised in a number of ways: due to their prominent status within the market; those that originated in the UK; contacts made using the online business matchmaking facility. This approach used advance planning to ensure time was not wasted trying to find businesses within the 'catalogue' or by walking around the trade fair stands. This

ensured that the maximum number of businesses could be approached during the three day fair, with 17 of the 160+ businesses at the event being questioned. Once the relevant stands were identified, suitable respondents were located, which within this heavily sales orientated environment tended to be a senior level sales person. The purpose of the trade fair event if for the technology providers to generate sales, meaning there were instances when the researcher was told the potential respondent had no time to answer the questionnaire. This was compensated by the fact that a number of the more established providers spent more time than anticipated discussing their technologies and merits of their applications. On reflection, attendance at this event significantly shifted the understanding of the variety of industry specific technology, and provided a valued realisation of one of the research objectives. It also illustrated that there are different types of companies providing facilities to the sector, further reaffirming the complexity associated with identification of potential products.



(original in colour)

Figure 3-10 Industry specific technology business identification strategy - IMB 2006

3.3.3 High street retail sector

Identification of the branded high street retail organisations to partake in E3 P1 was influenced by the companies' involved in the SizeUK survey of 2001, previously discussed within section 2.3.6. The choice of organisation was influenced by their involvement in the study, as this illustrated a forward thinking approach to the use of developmental technologies. This reduced the number of potential high street companies to be approached to 17[8]. The companies that were involved in this research programme are shown in table 3-5 below.

Table 3-5 High street retail organisations involved in the study

Littlewoods	Speedo
Marks & Spencer	Topshop
Rohan	

A variety of responses from a representative selection of business and product range types was required. In order to make a considered selection, the conglomeration of 17 businesses involved in the SizeUK survey were mapped by the researcher onto the matrix shown in figure 3-11, with representation from each of the quadrants required in order to generate a valid overview. A diagram showing further details of the 17 businesses involved can be found in appendix 2. Identification and consideration of each organisations retail strategy allowed informed positioning within the matrix relative to product range focus combined with potential consumer market. For instance Rohan and Speedo were placed in the Focused/Specialist segment as both offered specialist performance sportswear, which had a relatively limited target market. Another example was Littlewoods, whose core sales are conducted remotely, either through catalogues or the Internet which affects the variety of consumers attracted to their diverse product range. The use of this matrix ensured that identification of businesses from each quadrant would derive a reasoned unit of analysis by business type.

Within these larger organisations, relatively few members of staff were involved in the study, limiting potential respondents. In order to identify suitable participants, the researcher contacted Andrew Crawford of Bodymetrics and more recently Sizemic, to ask his advice. As he had worked closely with a number of the organisations that were part of the SizeUK survey, he recommended the staff members most likely to have

[8] Arcadia, BHS, Debenhams, Freemans, Grattan, GUS, House of Fraser, John Lewis Partnership, Littlewoods, Marks & Spencer, Monsoon, N Brown Group, Oasis, Redcats, Rohan, Speedo, Tesco

been involved would be a senior member of the garment technology team. In order that the relevant member of staff was approached contact was established by phone prior to distribution to confirm role status and availability.

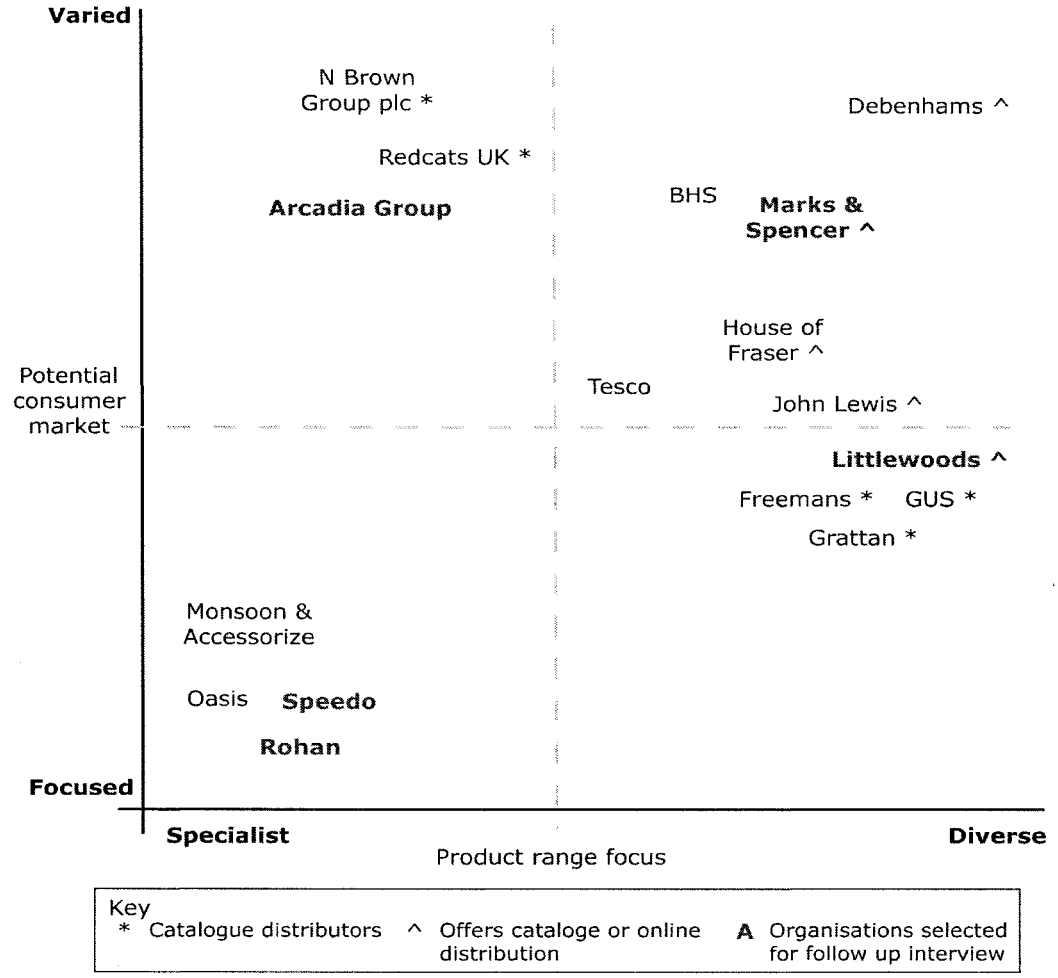


Figure 3-11 SizeUK retailer selection matrix

Initial contact was made with the respondents through the cold calling approach, in which the researcher contacted the company switchboard with only an indication of the job title as being Senior Garment Technologist. Contact names were gained via the switchboard, and where possible personal contact with the potential respondent was established to gain direct contact information such as phone number and email address. Prior to making the calls, a list had been prepared of points to explain to potential respondents, such as an outline of research, industry related credentials and an explanation of the requirements of their involvement. This approach to secure respondents is generally not recommended. In this instance there was no other way to make contact. On introduction the researcher stated she was conducting a PhD which may have made the receptionists more inclined to transfer the call. A high level of

confidence is required when approaching respondents in this way. It became apparent that by illustrating a real interest in their area of specialism the likelihood of their agreement to be involved is increased.

3.3.4 Summative interview

As the final phase of the data collection process, the summative interview was devised as the basis from which to discuss the findings of each of the research elements. Therefore the relevant respondent was required to have a broad based knowledge both of industry and government agency workings. The individual identified to be interviewed was a senior management staff member at Skillfast-UK, with a long established career in the textiles and the clothing manufacture sector, prior to moving into the role within Skillfast-UK. This level of practical industry specific knowledge combined with the awareness of current government policies and practices was considered a necessity for informed discussion of the findings.

3.4 Research methodology

The methods used to compile the data within this programme were devised in order to incrementally build an overview of the current industry. The findings from each element were obtained from disparate areas of the sector, utilising different research elements (referring back to figure 3-8). The findings were then considered, processed and where appropriate incorporated back into the investigation prior to conducting the next phase. This technique ensured that all new findings were incorporated into subsequent research phases in order that the subjects discussed within the interviews and focus groups were relevant. A visualisation of this process can be seen below in figure 3-12. The development of this diagram has evolved with the programme of research and offers an effective way to view the different processes and levels through which the data has been obtained and progressed.

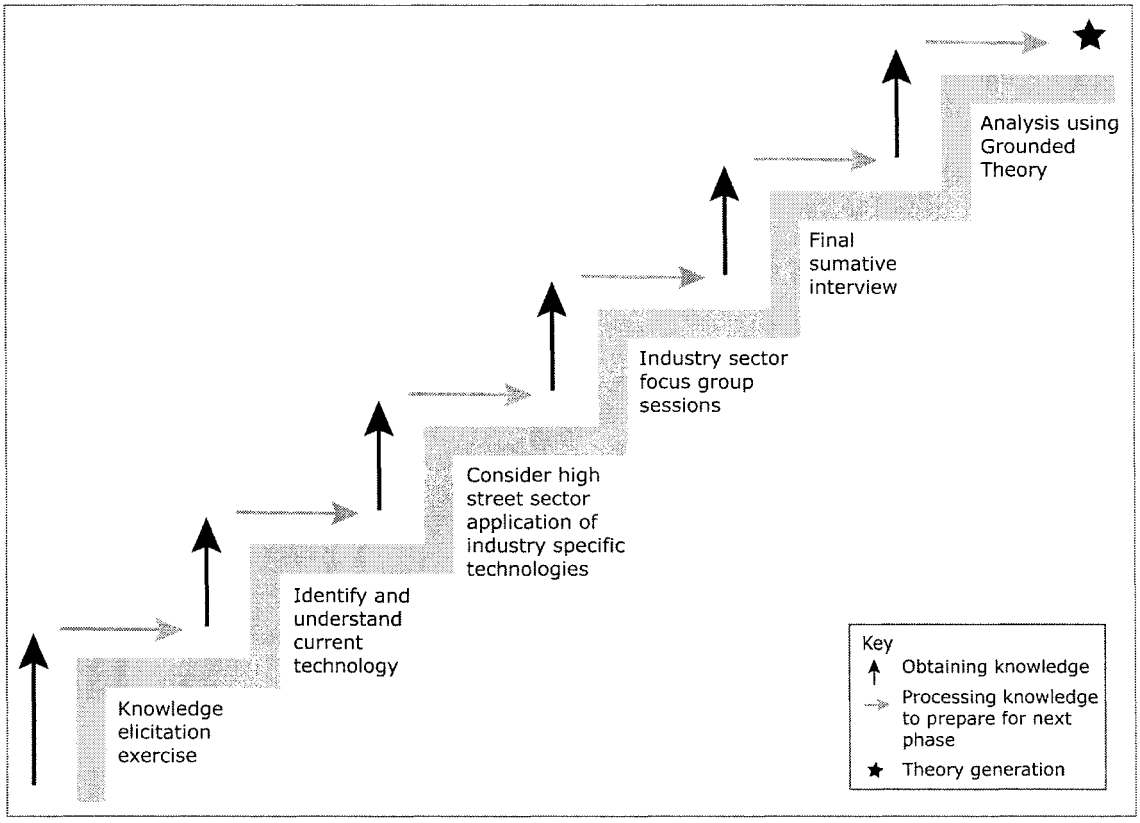


Figure 3-12 Incremental knowledge building

An important aspect in the development of the research methodologies was the dissemination of the process of writing and presenting of two peer reviewed papers at international conferences, which can be seen in appendix 1. The first paper was presented at LCF in a conference entitled International Conference of Fashion Marketing and Management. It outlined the principal aims of the research, in which the developmental approach to access tacit knowledge was explained, as well as the importance of the three key phases of data collection and processing; extraction, consolidation and cohesion (see figure 1-2). On reflection, even though the focus of the research, and therefore the process had altered, the underlying principle of the approach remained the same. The second paper was presented at a conference entitled Creativity: Designer meets Technology Europe in Copenhagen. The writing of which provided an opportunity to consider and refine the approach to the focus group element of the research. The process of writing and presenting both papers generated significant value to the study in terms of the thought process behind each subject matter, and the opportunity to raise the profile of the research being undertaken.

The researcher acknowledges that a number of the preparatory exercises conducted prior to the MPP stage had a definite slant towards the bodyscan focus. This is due to

E1 P1 originally being devised to query regional MSME businesses about the potential use of digital bodyscan data, and therefore the wording within the question referred to that. On a more specific level, respondents were asked to indicate which words within the terminology list would refer to use of digital bodyscan data, and alter and amend their agreement accordingly. In addition, the questionnaire used in E3 P1 was also distributed prior to suggested subject change, therefore there is a section dedicated to querying the business involvement in SizeUK. Consideration was given to how the inclusion of questions related to such specific technologies could potentially affect the findings, however the content both within the exercise and questionnaire ensured it was possible to redirect the significance. Reflecting on the initial digital bodyscan data focus and how the sectors worked with such specific technology, in a way informed the approach questioning their broader use of technology.

3.4.1 Element 1 – MSME clothing sector analysis

The extraction stage of the research process used within E1 of the programme was developed as a new way to access the tacit knowledge held within the SME sector of the clothing industry. Gaining access to the tacit knowledge of individuals working within the sector was identified as a key source to further understanding industry and the interrelationships that exist. By considering the different types of knowledge stored within the memory as is illustrated in table 3-6 taken from Clarkson (2005), gaining opinions on process insights will be vital to understand current industry practice. This programme of research has devised an approach that offers access to the type of specific tacit knowledge that is rarely considered.

Table 3-6 Classes of knowledge and information

	Stored externally	**Stored internally in human memory**		
	Information	**Explicit knowledge**	**Implicit knowledge**	**Tacit knowledge**
Process	**Descriptions of the process**	Explanations about the process (rationale)	Understanding about the process (strategies)	*Intuition about the process (insights)*
Product	**Descriptions of the product**	Explanations about the product (rationale)	Understanding about the product (relationships)	Intuition about the product (insights)

Source: (Clarkson & Eckert, 2005)

The complex nature of the industry being studied required an appropriate data collection method to gain the findings needed. A two phase approach was devised to fully explore the areas of focus within industry, design, manufacture and market. The investigation was formulated in a way that P1 extracted information through implementation of a sector specific knowledge elicitation exercise[9] (McNeese *et al.*, 1995). P2 was a series of three homogenous sector focus group sessions devised to consolidate the findings from P1. The final phase of the research consolidated all the findings, through discussion within a summative interview, the responses then informed the conclusions.

P1 - Different forms of formal questionnaire were considered which were outlined in 3.1.1, however it became apparent that identification of a method to utilise a more interactive/developmental approach to extract knowledge would generate more insightful results. Rather than use formal questions, a focused explorative tool in the form of a two-part knowledge elicitation exercise was developed, referred to within the research elements diagram (figure 3-7) as a preparatory exercise. The reference to 'exercise' was adopted as it was an atypical questionnaire.

The first section provided a list of words which required personal additions and selections to be made, the second section required the respondent to visualise their perceptions of aspects of the clothing process. Reference to McKim (1980) and Root-Bernstein (2000) identified the importance of visual thinking, and how it is possible for the thinker to translate human activity and interactions into a visual form. Extraction of personal perceptions in this way makes it possible to identify emergent trends that appear when individual responses are compared in appearance.

Initially, the exercises were distributed electronically with the instruction for respondents to complete and return, a version of this can be seen in appendix 4. Response was minimal, which resulted in the exercises being conducted more on a semi-structured interview basis, with the researcher being present whilst the respondent completed the exercise.

The first section of E1 P1 required personalisation of a series of word lists relating to different areas of the clothing sector; design, manufacture, market and technology.

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[9] The term *knowledge elicitation* is most strongly associated with the development of *expert-* or *knowledge-based systems* intended to replicate an experts' behaviour in some task domain. It generally denotes the process of identifying, soliciting, and codifying the subject expert's "knowledge". (McNeese, 1995)

These lists were compiled to enable the identification and mapping of industry specific words and terms used, as no comprehensive list of current terminology was available. Each respondent was provided with four sector word lists, see table 3-7 below, containing words and phrases indicative of terminology used within the sector, from which they were asked to add any terms that they considered to be missing.

This approach to data collection involved the listing of terms currently used within the sector. It was devised as a mixed method where data was being compiled within Excel using matrix tables, where basic quantitative totals were generated. This approach was considered important in order to identify any universals (Comrie, 1981; Clegg et al., 1999) which exist within and across the sector. The term universals relates to words which boast a collective meaning. This element of the study was originally devised as a means of identifying and acknowledging the terms being used. Providing a set wordlist as a starting point ensured that all participants were given the same opportunity to respond.

Table 3-7 Word lists provided within E1 P1 the preparatory exercise

Design	**Manufacture**	**Market**	**Technology**
Colour	Deadlines	Availability	Communication
Computers	Finished goods	Consumers	Computerised cutting
Inspiration	Machinery	Internet	Data storage
Past products	Operators	Location	EPOS
Pattern blocks	Planning	Outlet	Expensive to access
Pattern grading	Production lines	Profit/loss	Highly technical
Styles	Quantities	Retailers	Large data capacity
Target customers	Raw Materials	Sales	New processes
Trends	Seconds	Size ratios	Pattern grading
	Size ratios	Stock	Restrictive
		Targets	Stock control
		Trends	Under utilised
			WIP System

Within the second section each respondent was given an A4 sheet of paper presented in portrait that was divided in two horizontally. Instruction was provided for the respondent to generate two mind maps or models that offered an accurate snap-shot of the way practitioners within the industry perceived interrelationships between the three industry sectors. The diagrammatic section of the preparatory exercise demonstrated

how each individual understood their process, and the extent to which they relied upon that knowledge.

P2 – Where possible, the sector specific focus groups for P2 included respondents who had completed the initial elicitation exercises. This phase was incorporated to ensure cohesion and continuity of the research data relating to the MSME sector. The aim of the focus group sessions within P2 were designed to further elicit participants' feelings, attitudes and perceptions (Puchta & Potter, 2004) about the clothing industry by discussing the findings from P1. Devised as a continuation from the elicitation exercises they were used to consolidate the perspectives of representative individuals from across the regional clothing sector. Each session was conducted with sector specific homogenous groups, in order that the common backgrounds and experiences of the group members would facilitate effective communication (Robson, 2002). This approach ensured that the findings from each sector were discussed by representatives of the given sector to gain further insight and understanding of the original findings.

Three focus groups and one pilot were conducted over two locations, therefore prior to the sessions each location required preparation following the guidelines given by Langford (2003, pp 36). The pilot and the first session were undertaken at the CfDR, the second and third were held at an event in an external location organised by Skillfast-UK. As with all focus groups, the arrangement of participants and the position for the moderator (researcher) has to be considered to ensure face to face contact (Langford & McDonagh, 2003). The final consideration was ensuring the moderator's assistant was positioned to take notes and monitor the video recorder, whilst the moderator ensured the digital recording device was in place on the table. As the session began, a brief introduction was given, and explanation of the facilities, informed consent and health and safety prerequisites. In addition, each participant was requested to state their name for transcription purposes.

From the participants point of view, being within the focus group environment can feel very unnerving, therefore it is recommended that at the beginning of a session immersion or warm up exercises are used (Langford & McDonagh, 2003). The approach identified in this instance was the round-robin technique (Langford & McDonagh, 2003) and involved generating a number of open ended statements, outlined in table 3-8, that were printed portrait on A3 paper. After the initial introductions, the statements were handed out at random and the participants were

given two minutes to add their own responses to the original statement, once complete they were passed on. When each participant had commented on all of the statements, they were asked to read through the comments on the sheet they were holding, identify pertinent issues and discuss. Adopting this approach ensured that the participants were fully tuned into the subject area that would be discussed within the main body of the session.

Table 3-8 Statements distributed within the round robin exercise

C1 Potential gains to be made through the use of technology within the clothing industry MSME's are...
C2 Other than outlay costs, the factors influencing an organisations decision to invest in technology would be...
C3 The most annoying thing about high street clothing fit is...
C4 The area of clothing industry MSME businesses that would benefit most from the use of industry specific technology is...
C5 If there was a market for batch produced clothing goods in the UK how realistic would implementation be...

Working with four sector specific (design, manufacture, market, and technology) wordlists compiled during E1 P1 formed the first major component of the focus group exercise. The intention of the task was to conduct a list reduction exercise (Langford & McDonagh, 2003), which is a filtering technique applied within a focus group in which it is possible to reduce large lists to a more manageable size. The approach adapted from the method was to present group members with magnetic boards (100x50cm) that were divided into two sections, allowing two sets of word lists to be considered. The word lists were provided to the participants on the white boards, one with the lists from design and market, the other manufacture and technology (see figure 3-13). Using the magnetic boards allowed the participants to pick up words and move them around. Using this approach, the tactile, token like components gave the participants a sense of ownership of the words, rather than just reading them from a list. Within the sessions, depending on size, the group was split into two, allowing each half to consider two sector specific lists. After an allocated period of time, group members were required to feedback their decisions relative to the choices made, generating further discussions.

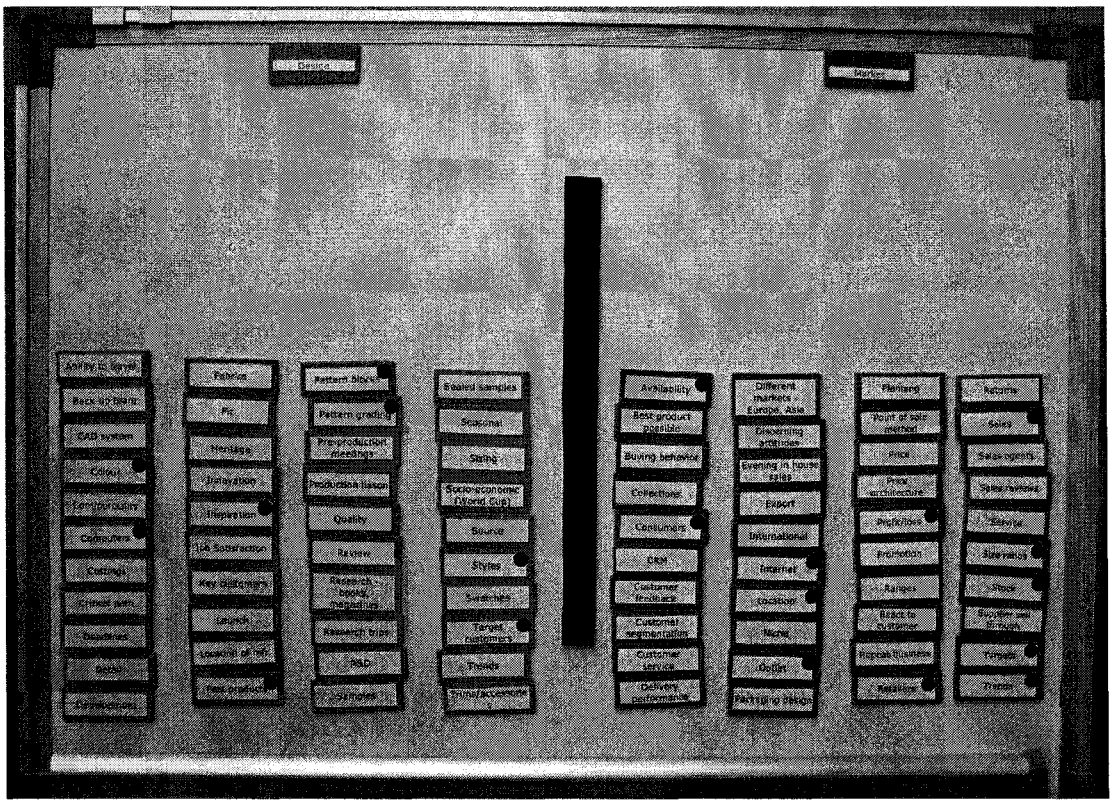

Figure 3-13 Image of magnetic board for Design and Market word lists

The second major element of the focus group exercise was discussion around the diagrams/process maps created within E1 P1, these can be viewed in appendix 6 and 7. Again, each focus group followed the sector format, discussing the findings from P1 which in the case of the diagrams had been translated into an electronic format for presentation purposes. Each set of sector specific diagrams were compiled onto two landscape A4 sheets, the first showing their industry sector overview, the second illustrating perceptions of the industry as a whole. The two sheets were distributed together, with the sector overview on the top. In addition to the diagrams, sheets were distributed entitled 'how many times' which identified numerically the frequency of use for each word, variations of which can be seen in appendix 8. The participants were asked to consider the diagrams on the first sheet for two minutes, then to discuss their choices in an attempt to identify the most representative model. Using this approach gave each individual participant the opportunity to make a selection and justify their choice, therefore ensuring an informed decision.

The importance of E1 of the research was to work with regional MSME's to extract initial information, which was discussed to form more cohesive findings. From a research point of view the value of gaining access to local businesses, holding one to

one discussions and conducting the focus group sessions added to the overall understanding of the sector as well as addressing the aims and objectives of the research programme.

3.4.2 Element 2 – Enquiry into IT service providers

This element of the data collection was incorporated following the broadening of subject focus by the Mid Point Progression review panel. As the preliminary research conducted had been based on the application of digital bodyscan technology, it was vital to the continued success of the programme that further insight should be gained in the broader spectrum of technology available to the clothing sector. A review of related and upcoming events identified promotional material for IMB Cologne, which is a tri-annual clothing industry fair, promoted as the largest of its type in Europe. Attending this event created the opportunity to personally approach representatives of worldwide industry specific technology providers to the clothing sector.

To gain maximum benefit from this opportunity, a short questionnaire was devised as a way to effectively obtain key information from the technology providers. The approach to questionnaire content and design referred to Robson (2002), Oppenheim (1992) and Bernard (2000) to ensure they were appropriately constructed and executed. The content incorporated a section to identify specific company details, then six questions dedicated to product and service facilities, source of sales and examples of pricing strategy, a version of this questionnaire can be viewed in appendix 4. For speed the questionnaires were completed by the researcher rather than the respondent, with five of the six questions using tick boxes for answers. Where additional comments were made, space had been incorporated to add notes. The final question was included to query pricing strategies, as this is an area some organisations are reluctant to discuss the respondents were given the option to decline to answer.

As outlined in section 3.2.2, the reason that trade fairs exist is to promote new products and innovation but primarily to generate sales. Therefore completing a questionnaire at this type of event can prove difficult as business representatives are often unwilling to speak to people who are not from trade. Aware of this fact, the event was approached in an organised way, where possible requesting by name the contacts made through the business matchmaking. Also it was vital to take advantage of the quieter times, such as first thing when the technology providers are there, but the crowds of potential buyers are not. This strategy was considered successful, as a

representative proportion of the suppliers of industry specific technologies that were showing at IMB 2006 were questioned. This form of direct questioning obtained usable data and more detailed and specific company information that is not generally available through secondary research sources, which added further value to this approach.

3.4.3 Element 3 – Study of IT use across the retail sector

Initial consideration of the clothing sector identified retail or market to be a vital component of the UK clothing and fashion industry. This element of the investigation was incorporated to consider how the high street retail sector utilised technologies. This insight was obtained from the point of view of senior level garment technologists who were considered to have an understanding of the product from conception to final dispatch. The respondents were identified as most appropriate as they consider the product from an informed position, whilst being aware of the priorities of the retail sector. A two phase approach was devised to obtain the most information from this area of the sector, generally overlooked by the research community. A questionnaire was devised (Bernard, 2000; Robson, 2002) and distributed to gain information about the types of technology used within their organisation (this can be seen in appendix 4), this was returned to in preparation for the follow up semi-structured interview.

P1 – The content of the questionnaire were broken into four main sections, with the areas of focus being:

What technologies were used?
What the technologies were used for?
Were the systems integrated?
How were they identified?

In addition there were specific questions about SizeUK data use. These topics were selected to provide an understanding of how large organisations dealt with issues relating to technology. It is intended that the responses would be interpreted to identify potential problems/solutions that smaller organisations could encounter. A decision was made to distribute the questionnaire electronically. An initial email was distributed providing the respondent with a hyperlink to the researchers designated area of the CfDR website where the questionnaire and research rationale was posted. There was anticipation that responses would be limited, therefore follow up prompts were issued at designated points, after a week, then again after three weeks (Robson, 2002).

P2 – Once the data from the P1 questionnaires were compiled, a series of questions were formulated to gain further insight into the respondent's knowledge. Incorporated as an ice breaker were a series of questions specifically relating to the respondent, their career development progressing towards a focus on their current role. The subsequent phases gained opinion on technologies, business considerations and SizeUK data use. Use of the semi-structured interview technique ensured that all the areas important to the research programme were considered. In addition it offered a valuable opportunity to speak to senior garment technologists who were heavily involved with high street products, from the design concept to checking pre-production samples and finished goods.

3.4.4 Summative review of findings

This element of the research programme was incorporated in order to provide cohesion to the findings from all previous stages. Originally conceived as a heterogeneous focus group to follow on from the sector specific focus groups (E1 P2), the benefit of conducting a one-to-one interview ensured increased focus to this summative discussion. In preparation for the interview all summarised findings within the profile matrices generated in the earlier phases were compiled and prioritised for discussion, as the time allocated was limited. The interview began with a summary of the data collection programme, as outlined in the incremental knowledge building diagram shown in figure 3-11, followed by more focused discussions on E1, 2 and 3 of the research. The principal intention of the summative interview was to obtain feedback on the findings and discuss the research approach.

3.5 Understanding the research outputs and outcomes

The approach to this study utilised questionnaires and exercises to form the basis for subsequent interviews and focus groups therefore individual and group opinions (Robson, 2002) were taken into account. The data compiled generated different types of findings for which appropriate units of analysis were identified resulting in both quantitative and qualitative analysis being undertaken. Quantitative interpretations of data obtained during the preparatory exercises provided insights that enable the development of theories to evolve within the discursive elements of the study. This approach is a variation of that outlined by Fielding (1986, pp 27) in which he proposes that there are benefits associated in combining the two forms of analysis, which is also echoed by Strauss (1990, pp 18).

The consideration of the wordlists, and therefore the terminology utilised within the sector, effective analysis of the terms compiled was required. The process undertaken for analysis occurred iteratively, in three stages using a process that evolved from a basic form of tabulated approach (Barnard, 2001). When the terms were initially compiled frequency was used to illustrate the number of selections made. As the wordlists then undertook a refinement process, the terms were quantified through the identification of the most commonly used words across the three sector groups in which this task had taken place. All the selections were compiled into a single list in order to identify the terms that were identified most frequently. This process ensured that the words shown as being representative illustrated a consensus over all of the groups. The selected words were finally considered within the summative interview in order that a review and reflection process would identify any key terms that had been omitted.

Forming one of the more developmental elements of the data collection, the process diagrams obtained within the preparatory exercise generated graphical interpretations that had to be individually analysed.

The nature of the process diagrams or mapping technique is similar in concept and method to cognitive mapping. The difference in this instance was rather than using focussed discussions to identify elements of the process, participants were simply asked to visualise their understanding. Tyler (2001) published a paper outlining the processes involved in conducting a cognitive mapping study of a company representative of the textile industry. The mapping process was undertaken to be utilised to aid the strategic development of the given organisation. This process adopts the approach that discussion of practice ensures current processes are visually mapped. Once in place the cognitive map is entered into specialist software, which in this instance was Decision Explorer (Tyler, 2001), to be viewed. Once in place the software offers the capability to generate alternative scenarios to be considered without making physical changes. It became apparent that by illustrating the potential gains from the use of this technique that participants were able to engage more effectively. Although this process offers many benefits to the analysis of processes, this approach was not utilised in this instance.

Analysis of respondent generated process maps appeared to be relatively straightforward, however following advice obtained from a sociologist based at LCF,

Joanne Entwhistle, this was readdressed. She recommended that the information captured within the diagrams should be considered in a sociological way;

> A sociologist would not treat an account at the level of this material/diagram as it is a direct and unmediated view of the real world. Within the interview encounter it is artificial, as they are being asked to reflect on practice which they would not normally do, or if they do, not in the position where they are being asked questions about it. So really the diagrams will not be what people actually do, they will be an account of it.
>
> (Entwhistle, 2006)

This advice was taken into account and informed the decision to utilise the analytical approach that is outlined below.

For the purpose of this study, the method identified for analysis was the systems thinking approach in which Checkland (1999) and O'Connor (1997) illustrate the processes required to systematically analyse the diagrams. The approach adopted by each author was carefully considered prior to conducting the analysis. The approach advocated by Checkland (1999) appears to be based on consideration of a system from an external point of view, and from there the identified processes are applied into a standardised activity model. What was required for this study was to quantify individual industry practitioners interpretations of the system in which they are involved. It was the straightforward, logical approach of 'seeing how a large system is made up of smaller subsystems' that swayed the decision to base the analysis using a variation of the technique devised by O'Connor (1997). This approach enabled identification, interpretation and application of the approaches identified within the text. This allowed the diagrammatic data to be considered in a structured and methodical way, as can be seen in table 5-5 which illustrates the complexity analysis process undertaken to quantify the content and the form of the diagrams.

A grounded theory approach was adopted for the interpretation of the findings and the generation of theoretical concepts. Using the grounded theory technique would ensure that the findings from the empirical industry related data would be reflected upon, interpreted and validated to formulate theoretical concepts (Strauss & Corbin, 1990). The process of analysis requires key categories within the findings to be identified, of which further questions are asked in order to develop further lines of speculation. Whilst undertaking the analysis researchers are encouraged 'not to force theoretical

concepts on the data' (Kelle, 2005) as the principle behind the approach is to allow the theories to emerge from the findings (Strauss & Corbin, 1990).

The grounded theory process utilises the qualitative analysis approach to coding, and it is recommended that an open coding approach is adopted (Robson, 2002, pp 174) in which the textual data is broken down, examined, compared, conceptualised and categorised (Strauss & Corbin, 1990) prior to development of the theory. Further aspects to consider relative to theory development are the: properties – attributes or characteristics pertaining to a category; and the dimensions – location of the properties along the continuum (Strauss & Corbin, 1990). Using these indicators is necessary when considering the relevance of possible significance, and also ensures that theories are organised and structured in order to generate a more structured argument (Coffey & Atkinson, 1996). This approach will ensure that the findings relevant to a future theory is methodically accounted for and utilised.

The method involved in interpreting the principles behind the grounded theory approach strengthened the reasoning behind its selection. Undertaking a study that considers a situation, in this case a proportion of an industry, from a number of perspectives was possible through the application the triangulation methodology (Robson, 2002). This offered a structured approach to the data collection that required a suitably controlled approach to analysis of the findings obtained at each element and phase of the study.

3.6 Summary

The identification and understanding of all the relationships that exist within the clothing industry has been a major consideration in the development of the research framework. Engaging with the considerably complex nature of the clothing industry has identified that there are many elements which required investigation in order to ensure the findings were sufficiently robust. As outlined within this chapter, the development of the research focus required adaptation of the methodologies used, from a more focused to a broader product type. The transition which occurred between the intended approach and the approach that was ultimately applied worked effectively, due to the original preparation undertaken prior to implementation.

This research programme has been devised to generate findings relative to a focused subject investigating interrelationships and technology use within the clothing sector.

Re-iterating the observation made by Jones (2002), research and development within the clothing sector is significantly under represented, especially in terms of the application of newly available technologies. In this instance, it is intended that the knowledge generated be utilised within the clothing industry. However, application of new technology involves considered decision-making in terms of investment, as the findings could suggest a wider scope for application. The methods devised within this research programme could be effectively applied to design industries in other fields as disparate as transportation and furniture. It was identified that further reflection could recognize opportunities for application across other industries and sectors.

There is also the transferability aspect related to the developmental research methods used within the programme. Within an industry environment it is difficult to extract and elicit the tacit knowledge that exists within a workforce relative to a specialist area. This research process could form the basis of a system of obtaining, considering and developing inherent workforce knowledge that will encourage involvement during the interactive data collection processes. In this instance, the processes to elicit information were tailored specifically to the clothing sector. It is proposed that this format can be transposed to any comparable industry or business situation.

Chapter 4 Approach to data collection

4.1 Introduction

The following text outlines the mode in which the data has been collected. A clear understanding of the systematic methods that were used would enable this study to be repeated if required, therefore in each instance details of pilots, approach to respondents and the implementation of each task (location, time pre-requisites, issues) have been fully considered. This has been compiled in order of occurrence within the study.

4.2 How data collection elements were undertaken

There were a number of considerations required during the development of the data collection process as this research programme was investigating three disparate areas of the clothing sector; regional MSME businesses, international technology suppliers and representatives of the high street retail sector. Therefore, type of business and role of potential respondents had to be considered in order to appropriately implement the research methodology.

A vital factor to the effective undertaking of the data collection was the personal aspect, coming from an industry background gave the researcher prior knowledge of the subjects in question and therefore an empathy with participants. Professionalism was required throughout the research programme. However, some instances dictated a formal approach, where others were less formal. A principal consideration was the need to be adaptable to the nature of the companies being studied, as within the scope of the research respondents could be sole traders through to the senior management within a multinational organisation. Encountering the diverse individuals identified as representative of the MSME, high street retailers and technology providers further illustrated the breadth of experience present across the sector. Having an industry background ensured that the researcher was able to personally relate to instances experienced by the respondents, which enabled further information to be elicited through informed query.

The diagram included in figure 4-1, has been taken from the overview of the entire research process and incorporated as a reminder of each element included in the data collection.

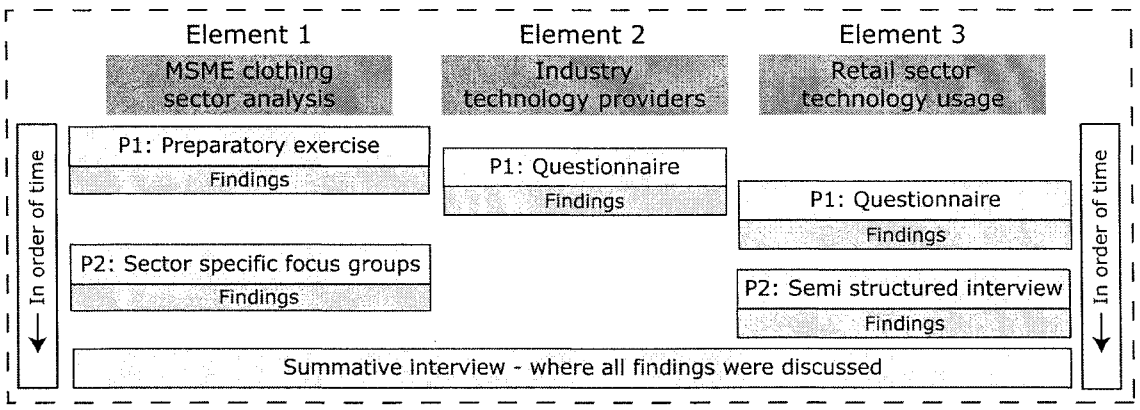

Figure 4-1 Order of data collection

Successful execution of the data collection as outlined above required consideration of prerequisite aspects, identifying and securing a respondent, finding a suitable location, and arranging a convenient time.

4.2.1 Development, finalising and piloting data collection actions

The vital component to the development of any data collection process is effective use of piloting. Therefore prior to undertaking the data collection each phase and element was piloted before distribution or implementation. As the researcher was based at the CfDR for the duration of her PhD, access to Design Research Associates as test subjects was generally utilised. Where more specific fashion related knowledge was required academic members of staff within the School of Design were approached. This section will explain the process of finalising the content of each element and phase and the instances in which piloting was implemented.

E1 P1 – The development of the initial preparatory exercise as a new form of data collection had no comparative examples available as templates. There were many aspects to consider including the content, format, detail of instruction as well as the title (see appendix 4). As the exercise incorporated two components, the word list and the diagrammatic elements, each was developed with independent priorities, which are outlined below.

For the word list, the content had to be representative of terminology currently used within the sector, these were devised from the review of literature sources (Tyler, Carr & Latham, 2000; Jones, 2002) which was revised refined with supervisor input. The

lists provided sufficient examples to illustrate the intention of the exercise, but not so many that the respondent believed they had nothing to add. The list was compiled over a period of time, with time allowed for additions, amendments, and contribution obtained during supervision. In addition, the phraseology used within the instruction constituted an important element for effective completion of the exercise, as can be seen in table 4-1 below, the words provided were entitled 'aspects', which was a word that could be incorporated into the instructions to clarify the section to consider. The content of table 4-1 shows how the word lists were presented to the respondents, organised by industry sector, but offered in random order. This approach was used to provide a common starting point, with terms that were recognisable to each respondent (Robson, 2004), with the randomness incorporated to stimulate more personal and diverse responses. The development of this process benefited significantly through the piloting process, as the lists were tweaked and refined to create a valid starting point for the exercise to identify currently used keywords.

Table 4-1 Word lists provided for E1 P1

Sector	Aspects
Design	trends, colour, styles, pattern blocks, computers, pattern grading, target customers, past products, inspiration
Manufacture	raw materials, machinery, planning, quantities, finished goods, production lines, operators, size ratios, deadlines, seconds
Market	retailers, consumers, outlet, internet, stock, sales, profit/loss, location, targets, trends, size ratios, availability
Technology	communication, EPOS, stock control, new processes, pattern grading, data storage, computerised cutting, WIP system, highly technical, large amounts of data, expensive to access, restrictive, under utilised

For the diagrammatic section of the exercise, the development process was heavily reliant on piloting and testing the process. Many variations of the instruction wording were considered, issues arose as to the level of detail required for instruction. Also, in regards to the content and formatting of sheet, each aspect was tested prior to distribution of the exercise. Part of the exercise required the respondent to generate a process map or mental model illustrating their understanding of their sector and of the industry. The terminology to be used within the instruction was considered to ensure full understanding of the process. At one stage the incorporation of a miniature

representation of what was expected was considered, however that was deemed to be too leading and therefore not pursued. The final version used two concise instruction statements for the respondents to create two process maps on a blank sheet of A4 paper divided only by the title for each diagram.

A further concern realised during the development was the format of the exercise to be distributed. In order for the exercise not to appear too lengthy, it was designed to be presented on two pages, with the word list section on the first page and space for the diagrams allocated to the second page. This required design of the exercise layout to be sympathetic to the content. Instruction for the word lists was given in the form of points relating to a table below incorporating the words/aspects to be considered and added to. The instruction for the process mapping element was situated below the aspects table, in order that the second page would have maximum space for the respondent diagrams. A version of the preparatory exercise can be viewed in appendix 4.

Once a draft version had been created, an in-house pilot within the School of Design, approaching Fashion Design and Fashion Marketing members of the academic staff was conducted. The exercise was distributed electronically, which was the way the actual exercise was to be sent out. This pilot took place just before the Christmas break, which in hindsight after receiving very limited responses may have been an inappropriate time. From the responses received, it was apparent that the requirements of the exercise were understandable, and achievable, indicating that it was suitable to be distributed.

The final requirement pre-distribution was to formulate the accompanying information, such as outline of topics to be included in calls made to identify potential respondents, also the text used within the email distribution. Consideration of every aspect of the call or the email was vital in order that an appropriate and professional impression was given to potential respondents.

E2 P1 – The industry technology providers component of the research was created to query a section of the industry with a specific and specialist knowledge base. Being based within an educational environment that utilised only limited industry specific technologies and therefore had little relation to the area being queried, undertaking a formal pilot was not possible. In this instance, a questionnaire was devised within a limited time scale, as attendance of the event was only confirmed a week prior to the

three day fair. A questionnaire was devised that was considered appropriate for the intended respondents, keeping the questions of a direct nature. However the questions were not only designed to effectively elicit information at different levels and general insights into products, but also more specific cost related questions that would otherwise be unavailable through secondary research.

As the data collection was taking place at an international trade fair, the content and format of the questionnaire was considered to be crucial. As this aspect of the data collection was being undertaken in a very hectic environment, the researcher had to ensure the questionnaire was presented in a way that fully utilised the opportunity. As the intention was to approach individuals on the trade stands, showing the potential respondent that the exercise was a concise single page of A5, with six questions, it was anticipated that willingness to partake would be more forthcoming. The layout was designed so that the respondent related information was grouped together at the top with areas to obtain company related details, followed by five tick box questions, and a final, more open ended question (see appendix 4). To give a professional look to the document, the CfDR logo also address and contact details at Northumbria University were incorporated. This enabled some respondents to complete and return at a later date. This approach was very effective in the trade fair environment, as cumbersome paperwork was avoided, and yet was able to maximise the data compiled by having the majority of those approached agree to complete the questionnaire.

Prior to attending the event an online version of the exercise accompanied by a research rationale (also provided in appendix 4) was prepared. The research rationale document concisely outlined the intentions of the research programme. This was devised as an alternative contingency in the eventuality that those approached at the trade fair offered to complete the questionnaire at a later date. In this instance the facility was not used.

E3 P1 – Formulating a questionnaire for retail sector representatives followed many of the same principles as previous sections, which required the creation of an appropriate series of questions that could be easily interpreted, completed and returned. The development incorporated consideration of content and format, but also created discussion points for the interview in E3 P2. As with E2 P1, there was insufficient knowledge base by which to conduct a formal pilot of this questionnaire, however colleagues within the CfDR were asked to consider the questions and give feedback.

The content of the questionnaire incorporated a box to gain specific respondent details, with the main body divided into three themed sections, IT overview, Business Considerations and questions relating to the SizeUK study (see appendix 4). The section relating to SizeUK was devised and implemented prior to the change of focus at the Mid Point Review stage. It had been incorporated as their inclusion in SizeUK formed the basis of the selection process (see section 3.2.3), also it was an opportunity to question first hand the organisations that had been involved in this technologically developmental study. The IT and Business Consideration sections were included to provide the basis for the questions to be asked within the interview that followed. The questions predominantly required yes or no answers, with the final question in each section asking for additional comments. Various formats were considered for the document, which in the end mirrored the template devised for E2 P1, incorporating CfDR logo and contact details.

In addition to the questionnaire, a detailed research rationale was also compiled to outline the researcher's background, to summarize the work being conducted and also an explanation of the ethical implications (see 4).

Distribution of the questionnaire and the research rationale was via email, therefore requiring the researchers contact details to be included. The questionnaire document was created with the intention that the response could be completed either electronically or manually, giving numerous options for return, email, post or fax. This approach was used to maximise the potential for returns.

E3 P2 – Devising the format of the semi-structured interview was based around the information elicited within E3 P1. Therefore the intended approach was partially in place. The main intention of the preparation for this was to create questions that will generate conversations that will elicit further information about the areas already queried.

The interview began with a series of introductory questions, in place of an ice breaker, in which the respondent was asked questions about their current role. This was followed by further questions relating to the sections on IT, Business Considerations and SizeUK. A final element was incorporated in which the respondent was asked if they had any questions regarding the research being undertaken. In general, the questions were phrased using leading terminology, asking the respondent to explain, or

outline a process or system. This approach ensured that there was an inherent structure to the discussions that took place, meaning each topic was discussed.

As the interviews were conducted at the respondent's place of work, it was important to provide continuity in the format of the question sheet. Prepared in advance the document used the same format as the questionnaire, with the respondents personal details entered in advance on the front page. Each section of the interview was on a separate page, allowing space below for notes to be added. The final page of the document was included to provide space to debrief the interview, immediately after completion. The methodical process used to create the document that formed the basis of the interview, ensured that the content of the interviews would have a common structure.

E1 P2 – Developing the content and structure of the focus group sessions was critical to a stage in the research in which representative findings were to be obtained. Having not conducted focus groups prior to this phase in the research, the researcher prepared by consulting text books relative to focus groups to identify processes and practices, Langdon (2003) and Robson (2002). The content of the sessions was based around the data compiled within E1 P1, supplemented where appropriate with data collected during other phases.

Prior to the actual sessions, a full pilot session was conducted to test content, structure, approach and then familiarise the researcher with the position of the moderator role. It was conducted within the CfDR with research associates and members of staff from the Fashion courses. This was a very beneficial exercise, as valuable feedback on the process was obtained from colleagues. Action was taken following the feedback, resulting in elements of the session being altered to be more effective and run more smoothly.

Summative interview – as the purpose of this final interview was to discuss the findings from the earlier stages of the research, with much of the preparation had been completed as the research progressed. As each element and phase were completed analysis was undertaken in order that findings could be incorporated into further stages, therefore the pre-compiled data was available on which to form the basis of topics to be discussed. All that was required in terms of preparation was devising an order to the topics being discussed ensuring the most important were covered early in

the interview. On reflection this approach was critical, as not all of the topics included were discussed in full due to time constraints.

Again due to the specific nature of the subject, conducting a formal pilot was not possible. Once the format and the structure of the interview was in place, the intended approach was discussed with colleagues and the supervision team to ensure all the relevant aspects would be covered.

Reflecting on the development and piloting process it was possible to consider the positive and negative aspects which occurred. During the development of the initial preparatory exercise, which formed a crucial component of the programme of research there was a definite reluctance of academic staff members to partake in the process, this issue will be discussed further below.

4.2.2 MSME preparatory exercise: E1 P1

This exercise was created to form the foundation or base level data of this study, which refers to the information that forms the basis of further elements of the research. The aim of E1 P1 was to encourage respondents to think about their own position in terms of the wider context, which identified opportunities for development and change to occur. Consisting of two components the first to gain an insight into terminology currently used within the industry and then to elicit respondents perceptions of the industry. An indication of the expected duration of the exercise was given to all respondents, with no specific time limit stated. This approach was adopted in order that they would take as much time as was required. In the most part the exercise would take between 10-20 minutes to complete, however this was dependent on the amount of further questions and extra curricular discussion the respondent wanted to add.

In the first instance, the preparatory exercise was distributed electronically, as it had been intended for the respondents to complete and return completed forms from their workplace. This mode only received one response, resulting in a more conventional one to one interview style approach being adopted. In this respect, the term 'interview' is used very loosely, as there were no questions, it almost translated into a reason for the respondent to dedicate the time within their workday to completing the exercise. The majority of the 18 completed exercises were conducted at the respondents' place of work.

On reflection of the original intention to conduct this exercise remotely against the way in which this phase transpired, it was considered that the latter was more appropriate and far more insightful. Much was gained by meeting the respondent face to face, seeing the different places of work and communicating with an individual rather than just a name on an email. This approach also created a relationship with the respondent which added further value when recruiting and conducting the focus groups in E1 P2.

4.2.3 Technology providers' questionnaire: E2 P1

Prior to conducting this element of the research, the researcher was aware there was only a limited window of opportunity in which to obtain the intended data. This is as the questionnaire was to be implemented at Europe's principal clothing industry trade fair, IMB. The full trade fair only takes place tri-annually, with supplemental Forum events taking place each year in between in which there is a smaller exhibition running alongside two days of congress sessions. Therefore preparation prior to the event was thorough in order to ensure this stage of the data collection worked effectively.

Having attended trade fairs prior to IMB 2006, the researcher had an expectation of the environment in which the questionnaire would have to be conducted. Each respondent was approached individually, either by asking by name for respondents who had indicated an interest via a business matchmaking facility, or independently approaching a potential respondent on the trade stands. The interviews were designed to gain maximum insight in minimum time, as the principal role of the trade fair environment is to generate 'trade'. Therefore, once the respondent was identified a brief explanation was given outlining the reason for conducting the exercise, before beginning the questioning. Each interview lasted approximately five minutes, depending on how much detail the respondent was prepared to give, or how much time they had available.

Conducting primary data collection in this environment required adaptability to the environment and circumstances of the show. For instance, there appeared to be factors that influenced the duration of the interviews, such as during the quieter times at the trade fair, or early mornings, respondents appear to like to be seen to be talking to someone, which could be to illustrate to potential customers that there is someone here taking an interest in our product. Also, there are the instances where the person you approach is from the UK but are working for an international company, and who

like the opportunity to talk more fully about their product to someone showing an interest not just from a business point of view. Essentially, by entering a situation 'cold', with little or no prior relationship with the respondent, there is no way of foreseeing how the interview would proceed. However, the careful planning undertaken prior to the event ensured the researcher was confident of her aims and intentions.

Reflecting on the process undertaken in E2 P1, the conciseness of the questionnaires worked effectively in this situation. With only a limited window of opportunity, use of this simplistic form of data collection was able to generate valuable information relevant to current technology provision. In addition to gaining an insight into available products and a basic insight into specification, securing respondents contact details was possible which could be of value at later stages in the research programme.

4.2.4 Retail sector questionnaire: E3 P1

This aspect of the data collection exercise was devised to form the basis of the semi-structured interview conducted in E3 P2. Having a prior insight into the areas which were to be discussed would ensure areas of focus could be identified in order to gain maximum feedback on key topics.

This stage was conducted remotely, with subjects identified using the process outlined in section 3.2.3. Initial contact was made with the garment technologists via phone, and in the first instance, each of the 17 businesses involved in the SizeUK survey were approached. The questionnaire was made available electronically, sending an email providing a link to the researcher's area of the CfDR website where the questionnaire and the research rationale was posted. Out of the 17 garment technologists approached, 4 completed questionnaires were returned and one expression of interest was made with non-completion of the questionnaire. As the questionnaire was designed as a self-completion exercise (Robson, 2002, pp 275), the approach adopted by the respondents was not observed. The response rate was a representative 24% suggesting that the questionnaire was appropriate for the respondent group.

4.2.5 Retail sector interview: E3 P2

The interview environment was an opportunity to further discuss the findings from the preparatory questionnaire. The responses from the first phase were entered onto a

matrix table in Excel to gain an indication of the trends within the findings, and so that all respondents data could be viewed together, to illustrate current high street retail providers opinions as to technological development and implementation.

Each of the interviews were arranged to be conducted at the respondent's place of work, in a location arranged by them. In four of the five instances the interview was in a formal meeting room environment, where the other was in less formal communal space, each lasting between 30-90 minutes. Utilising the semi-structured interview approach allowed initial leading questions to be asked in order to generate a conversational discourse, to which interjection of relevant questions were made where appropriate to gain further detail (Robson, 2002). This approach was effective in eliciting informative responses that were focused on the research subject.

Digital recordings of the interviews were taken in order that partial or abridged transcriptions (Cameron, 2005, pp 168) could be compiled. As the first two interviews were conducted in the same morning, removed from the researchers facilities to listen to the first recording to analyse preliminary findings and identify any key questions. However, before the final three were conducted this analysis was undertaken, identifying a number of topics to direct further questions.

From the researchers' point of view this stage of the data collection was considered one of the highlights of the research programme. The process of identifying senior level garment technologists, within prestigious, often very secretive large scale high street retail organisations, and then interviewing them at their place of work was a significant accomplishment. This undertaking was considered creditable, identifying and establishing contacts within large retail organisations who consented to be interviewed for this programme of research.

4.2.6 MSME sector focus group sessions: E1 P2

The focus group element of the research programme was incorporated as a way to discuss and methodically analyse the data compiled in E1 P1. Three sessions were undertaken comprised of homogenous groups relative to the design, manufacture and market sectors. Referring to texts describing the focus group process (Hines, 2000; Robson, 2002; Langford & McDonagh, 2003; Puchta & Potter, 2004), this approach was selected in order to ensure that within each group, discussion between members with common backgrounds would fully consider the elements incorporated within the

session. The main areas being considered were the industry related keyword lists and the process diagrams compiled by their relevant sector.

In order to maximise attendance, sessions were planned at times when most participants were available, however, despite careful planning the final numbers were limited by attendees circumstances. Where possible, contingency plans were in place to be implemented ensuring the groups had the minimum required attendance, which was 4 per session (Cameron, 2005, pp 162) to make certain the discussion was not restricted. The three sessions lasted between 60-85 minutes, sufficient time to gain the data required for further analysis.

As conducting the pilot had been so beneficial in formulating the approach to the focus group content, a transcription had been made of the session in order to check the way questions came across (Cameron, 2005), and the way respondents were able to respond. Consideration of the application of each element within the session was essential to ensure each process obtained the intended results.

The original format for each session was to have four sections, an ice-breaking round-robin discussion regarding the word lists, identification of representative sector and industry process map and finally a number of rounding up questions. Only the design session completed all four of the elements, due to not having the limiting time constraints encountered within the manufacture and market groups. This disparity did not significantly affect the resultant data, as the principal subjects were covered with the word lists and the process diagrams.

During the sessions, the group members were required to work individually and as small groups for different elements. The round robin and the process mapping were completed separately, after which group discussions were encouraged. In order to generate discussion around the word lists, subgroups were created to gain representative feedback within each group with the requirement to form further discussion as a summary of the selections. Working in this way encouraged different types of thinking, interaction and communication within the group.

Discussion relating to the diagrams created during the preparatory exercises formed a key component of the focus group content. Therefore an appropriate way to illustrate and discuss them was required. Within the pilot session held with colleagues from the CfDR the diagrams had been presented in laminated sheets to encourage comments

to be added that could be wiped down and re-used. This approach was not successful, and through further consideration the solution devised was to print the diagrams onto paper incorporating individual reference numbers for identification purposes during the transcription analysis. Versions of the six sheets showing the sector and industry overviews for design, manufacture, and market can be found in appendix 6 and 7.

After the focus groups had been completed a short follow up questionnaire was distributed that was based on the template of a critical incident questionnaire (Brookfield, 1995; Adams, 2001) in which the participants were asked to reflect on their involvement in the focus group sessions. The 20% response rate, with representation of each of the three groups provided a valuable insight and feedback on the implementation of the focus group session.

4.2.7 Summative interview

The final aspect of the incremental knowledge building process, the summative interview was incorporated in order to discuss and validate the findings obtained throughout the study. This stage of the research was conducted as an interview. However, initially the intention had been to conduct a focus group session inviting captains of industry in the clothing sector, government agency and academic representatives from across the UK. Following the issues faced securing attendance of the regional sector specific focus group sessions, it became apparent that devising an alternate, more focused approach would be more effective. Therefore the individual selected to be interviewed was chosen due to their industry and commercial experience, also their involvement with government agencies and professional bodies.

Within the interview there was an order to the elements being discussed, this approach was followed in order to ensure the topics believed to be relevant were incorporated. The session began with a brief explanation of the elements involved in the research programme, using the incremental knowledge building map to illustrate the building of the findings across the programme (figure 3-11). The areas on which opinion was considered to be of most value were the sector specific word lists and the process diagram, therefore a large portion of the discussion was concentrated on those areas. However, as these elements reflected current industry knowledge, discussing the data obtained and the subsequent choices made within the focus group session generated further areas for discussion. The findings from the technology providers questionnaire was discussed, which generated interest for the interviewee who had limited insight

into that field. Also, towards the end of the interview, the data obtained from the retail sector was also discussed, but only to a limited extent due to the time constraints involved. Considering the intended content of the interview and the researchers uncertainty of the allocated duration, the aim of obtaining final opinions on the findings was successful.

4.3 Reflection on implementation

As the research approach incorporated a selection of methods, the processes of implementation were governed by the method of approach. There were instances within the data collection process that required the respondent to work remotely using standardised instruction, whereas in some cases the researcher was present whilst an exercise or interview was completed. With the semi structured interviews and the focus group sessions content outlines were in place prior to the events to maintain the direction of the conversations. Due to the variety of approaches undertaken, adaptability was required in each situation in order to obtain the required results.

Conducting the exercises with regional MSME business representatives was one of the first real challenges of the research programme. Identification of suitable participants that adhered to the requirements of the research context as outlined in 3.2.1, where each would be based in the region, with the time and inclination to be involved was a task that was very testing. Once the MSME respondents were identified, the initial intention was to conduct the preparatory exercise remotely, distributing electronically in order they be completed and returned. As explained in 4.2.1 this approach was not successful and in hindsight with further understanding of industry practice a more direct person to person approach would have been planned from the outset.

Implementation of the questionnaires devised to query the technology providers was an opportune, yet successful and insightful component of the research programme. This element was compiled at short notice with a specific intention, to gain maximum relevant data in minimum time. As a requirement of the exercise was to gain a representative insight into the current industry specific technologies available a strategic approach to identify suitable providers, as discussed in 3.2.2. The resulting output illustrated the significant amount of information that can be obtained within the environment of a hectic international trade fair.

Gaining an insight into an aspect of the high street retail sector ensured the PhD study illustrated a contextualised overview of the UK clothing sector. As outlined in section 3.2.3, the retail organisations involved in the SizeUK national sizing survey of 2001 were selected to be targeted. Identification of suitable personnel within large retail organisation was required, due to their working knowledge of the product the Senior Garment Technologist was pinpointed as the role of the intended respondent. A sense of focus and determination was required to secure the contact and establish commitment to completing the questionnaire and interview. Out of the 17 companies involved in SizeUK four completed questionnaires were returned, and five interviews were conducted, giving an insight into different types of business within the retail sector.

Focus group findings relied on the dynamics that evolved within the group sessions. The role of facilitator was new to the researcher, but involvement with the focus groups within the CfDR offered an insight into appropriate structuring and best practice. The approach was devised to illustrate to the respondents the value of their involvement offering the opportunity to speak openly with relatively little guidance. Engaging with groups selected for their common interests gave great value to the research enabling the discussions to reveal the feelings, attitudes and agendas inherent to each sector of the industry.

The final interview was integrated into the data collection in order to discuss and confirm relevance of the findings obtained during the preceding stages. The process of identifying and securing a suitable subject required careful consideration, as the research dictated the person in question to have significant personal working knowledge of the sector, combined with an overall view of current developments. An appropriate participant was selected in the respect that an interest in the research subject and approach undertaken was shown, and much was gained through their knowledgebase combining industry and government agency experience. Supervisory advice obtained prior to conducting the interview ensured an order to the discussion was incorporated to make certain relevant aspects were discussed. This approach was critical, as due to the nature of the semi structured interview, duration of time allocated to each subject is flexible depending on the flow of the conversation and unanticipated discussions which occur.

When reflecting on the implementation of this research programme, a novel approach was required to gain the desired insight into the sector. The study also required

significant levels of industry contact, and as the research was undertaken with no previous contact network, all participants involved in the programme were approached solely for that purpose. Given breadth of information required from the interconnected subjects in the study, it was considered that the data collection undertaken adequately reflects the requirements of the research subject.

4.4 The process of analysis

Due to the nature of the research undertaken, a variety of approaches were adopted to gather the necessary data, therefore suitable processes of analysis were required. The incremental approach to knowledge building required the analysis of the data to be an ongoing process, ensuring that phase one findings would be incorporated into subsequent phases. This continual analysis and reflection of the findings ensured that at the end of each phase there was an awareness and understanding of the resultant data.

4.4.1 Analysis of extraction phase

The collection of data during the extraction phase required a suitable process of analysis to be devised for each element. The following paragraphs will outline the process of analysis utilised for the phases of the research that generated the first phase findings.

The data obtained during the preparatory exercise was compiled on an ongoing basis, so that any emergent trends could be identified. Once each exercise had been completed, any new words were added to one of a series of four matrix, one for each aspect; design, manufacture, market and technology. As the matrix was tabulated within Excel, the facility was incorporated by which the spreadsheet could illustrate the level of frequency to words that were added, therefore identifying the more commonly used words. This form of data capture also allowed the findings to be easily anonymised as required, whilst allowing awareness to be retained of which respondent gave which response.

The second dataset to be analysed was the process diagrams created to represent understanding of perceived sector and industry processes. The intention of this research phase was to create an approach to engage and encourage participants to think and apply their knowledge freely. The value of this mode is reflected in the insight obtained into the feelings, attitudes and agendas inherent within the different

industry sectors. During the earlier stages of the research, the diagrams were simply transferred from a physical drawing into an electronic format using Adobe Illustrator, which allowed the standardised representations to be effectively utilised. At a later stage in the research, the content of the diagrams were considered using a quantifiable method by analysing the components, links and levels of complexity of each image. This process was based on systems thinking (O'Connor & McDermott, 1997) principles, and allowed any themes in emergent properties to be identified and considered further. Two parts of this exercise had very different outcomes. There was a common element, words, the significance of which will be further investigated within the chapter 5.

The second element of the research was to query industry specific technology providers. A short questionnaire was devised, with questions requiring specific answers aimed at product specific knowledge the respondent, as a sales person at a trade fair would have. The results obtained were again compiled on a matrix within Excel allowing the tabulated results to be quantified. Compiling the data in this way allowed the findings to be easily viewed, and trends in the data to be identified which was beneficial at subsequent stages of the research.

The data obtained relevant to the retail sector was in two phases, the first from the questionnaire, and the second from the semi-structured interview. As with the previous two elements, the data compiled within the questionnaire was transferred onto a matrix within an Excel spreadsheet. Whereas the interview findings were of a qualitative nature and were analysed using the approach and processes outlined in the section below.

4.4.2 Analysis of consolidation and cohesion phase findings

The data acquired during the consolidation phase of the research programme was both physical in terms of the word lists and diagrams, but also textural in the form of the transcriptions that were to be qualitatively analysed. Where the selection of keywords and representative process diagrams made within the focus group sessions were made, these choices were required to be highlighted for further discussion within the summative interview.

The majority of the resultant data obtained within the focus group sessions and the summative interview was of a qualitative nature, an appropriate means of analysis was required. The decision was made to identify a suitable computer-assisted qualitative

data analysis program (Bazeley & Richards, 2001), which was QSR NVivo on recommendation of a colleague. Use of specialist software offers the opportunity to further investigate content, trends, themes as well as the subtleties of language use. This said, this type of system simply offers tools to aid the analysis process, as it is the researcher who makes the choices, forms the concepts and identifies and develops theories.

Using NVivo software offers the facility to code findings electronically, and as concepts emerge the program uses a node tree system where child nodes can be added for further detail. The term node when related to NVivo refers to categories. The node tree approach ensures data is considered from different perspectives to introduce further depth into the analysis, enhancing the development of more abstract frameworks. The coding process requires constant review and refinement, as initial insights identify many areas of interest which need to be honed down to formulate simpler, more coherent themes. This process works toward identifying the core categories which are key to the development of effective theory creation which links to the emergence of theories using the grounded theory approach (Strauss & Corbin, 1990).

Due to the capacity of NVivo, it enables any data in electronic textual format to be analysed. This meant that in addition to the full transcriptions generated for the focus groups and interviews during the consolidation and cohesion phases, it was possible to apply the same coding to analyse additional interviews, supervision meeting notes, text from emails and findings from earlier stages of the data collection. This ensures that any findings relevant to an evolving theory are applied.

One of the approaches when analysing qualitative findings is the importance of group-to-group validation (Morgan, 1997, pp 63), which suggests that by identifying more than one instance in which a topic is discussed, across a number of sources, therefore re-affirming the importance of that given subject. There are different factors influencing this; how many groups mention the topic, how many within the group mention it, and how much energy and enthusiasm is generated.

4.5 Development of approach to data collection

When planning the implementation of data collection methods within a programme of research, the approach is dictated by the desired success of the outcome. Within this

research programme, there were two elements of the original planned approach that were altered. The first was the implementation of preparatory exercise, the second the approach to the summative phase of the research.

As outlined above in section 3.4.1 the original intended approach to completing the initial preparatory exercise with the regional MSME businesses was for the respondents complete it remotely then to return either electronically, by fax or by post. When the exercise was first distributed, only one response was returned as had been intended, at which point it was realised that an alternative strategy would be required. The alternative approach was to arrange to meet with the respondent at their place of work, and complete it on a one-to-one basis. There were a number of perceived benefits associated change in approach, it ensured the exercise was completed, but also the researcher was considered as a person, with a name and a face, rather than just an anonymous contact made over the phone and via email. This personal aspect also aided the focus group phase, as where available respondents appeared more likely to be involved having previously met the researcher.

The second alteration was to the final summative phase of the research, the original intention having been to conduct a final heterogeneous focus group session. The intention of holding a group session that rather than having participants with homogenous interests, the perceived value of bringing together a group with a common interest in the clothing sector but with different working backgrounds would further enhance the findings. This intention was reconsidered after planning and conducting the three sector specific group sessions, one reason being due to the difficulties encountered in securing the attendance of participants, the second was the likelihood that the planned content of the session would be compromised through discussion within a group from different backgrounds. The decision was made to conduct the summative phase of the research as a one-to-one interview with a respondent who could bring the insight of more than one background, which in this case was of industry and government agency. This revised approach ensured a more controlled environment whilst still obtaining sufficiently valid opinions.

On reflection of the approach to data collection, the instances that did require alteration were conducted far more effectively than would have been the case without making changes. Having studied the clothing sector for an extended period, there came the realisation that the fluid nature of the sector requires an approach that should

incorporate an element of flexibility. However, changes in the approach were not made lightly, and were done so to ensure the aims of the research were achieved.

4.6 Summary

The basis of the approach to this research programme was to compile data from a number of sources using a structured program of elements and phases. This approach enabled a contextual representation of the clothing sector to be compiled. The implementation of the data collection was at times challenging, and where appropriate was required to be altered, but in the most part the data collection was undertaken as planned.

This research was embarked upon with no active industry contacts or networks, with all those involved identified and secured through processes and approaches outlined here. The nature of the clothing and fashion sectors are inherently highly competitive and in near constant flux, which presented issues in regards to developing and maintaining the commitment and engagement of individual respondents throughout the research process. Those individuals who did become involved subsequently showed their interest in the research subject by agreeing to be involved in further elements. There were also instances in which initial interest was shown but then at a later stage they cited time constraints as reasons for non-involvement. In the main, individuals who were approached did agree to take part in the study.

Conducting data collection across a number of industry sectors required significant levels of persistence. From the start of the research programme it became apparent that there would be issues securing commitment to questionnaire completion, allocating time for interviews and attending focus group sessions. Having previously worked within the industry, the researcher was aware that there were constant deadlines to meet, time constraints on tasks, travel involved with work, and general difficulties with time management due to the nature of industry practices.

As is common within research projects there was an element of frustration experienced by participants, in this instance industry representatives suggested availability yet were unable to commit when required. The assumption was made that the reluctance to commit to involvement was related to the time constraints outlined in the previous paragraph. However, during the piloting of the preparatory exercise and the focus group reluctance also occurred from fellow members of academic staff. Consideration

of this experience in hindsight has led to further value through the use of research tools such as the critical incident questionnaire as outlined in 4.2.6, in which after being involved in an element of research the respondent is invited to offer a form of feedback, which may improve future approach to conducting research in the sector. The only limitation with this approach, is that the person who is reluctant to fill in the questionnaire would also be reluctant to complete the feedback sheet

Chapter 5 Results

5.1 Introduction

The approach to data analysis as outlined in section 3.1.4 has incorporated different methods and techniques appropriate to the findings compiled during each element and phase.

The examination of the data was undertaken at two levels, collection of base data followed by a section in which a discursive approach was adopted to discuss the findings obtained within the initial phase. This ensured that the resultant findings were based on data collected from industry practitioners, discussed by groups of industry representatives and finally reaffirmed by government agency and former industry practitioner. The analysis of the results will acknowledge the way in which each element influences or affects the other element, and the significance of this. This concept links to the initial intention of the research in the way that the data compiled within each stage of the research influences subsequent stages.

Each industry component MSME's, technology suppliers and retail sector representatives have their own understanding of how technology is used within the sector. This is something that will be illustrated through the analysis process. The research programme was undertaken using three different elements to investigate the aspects of the current sector. The diagram below in figure 5-1 illustrates how each of the three research elements come together to compile the findings. The results portion of this document has been approached in a way that examines the findings from each element individually, in order that common themes can be identified and considered in more depth within the discussion chapter which follows.

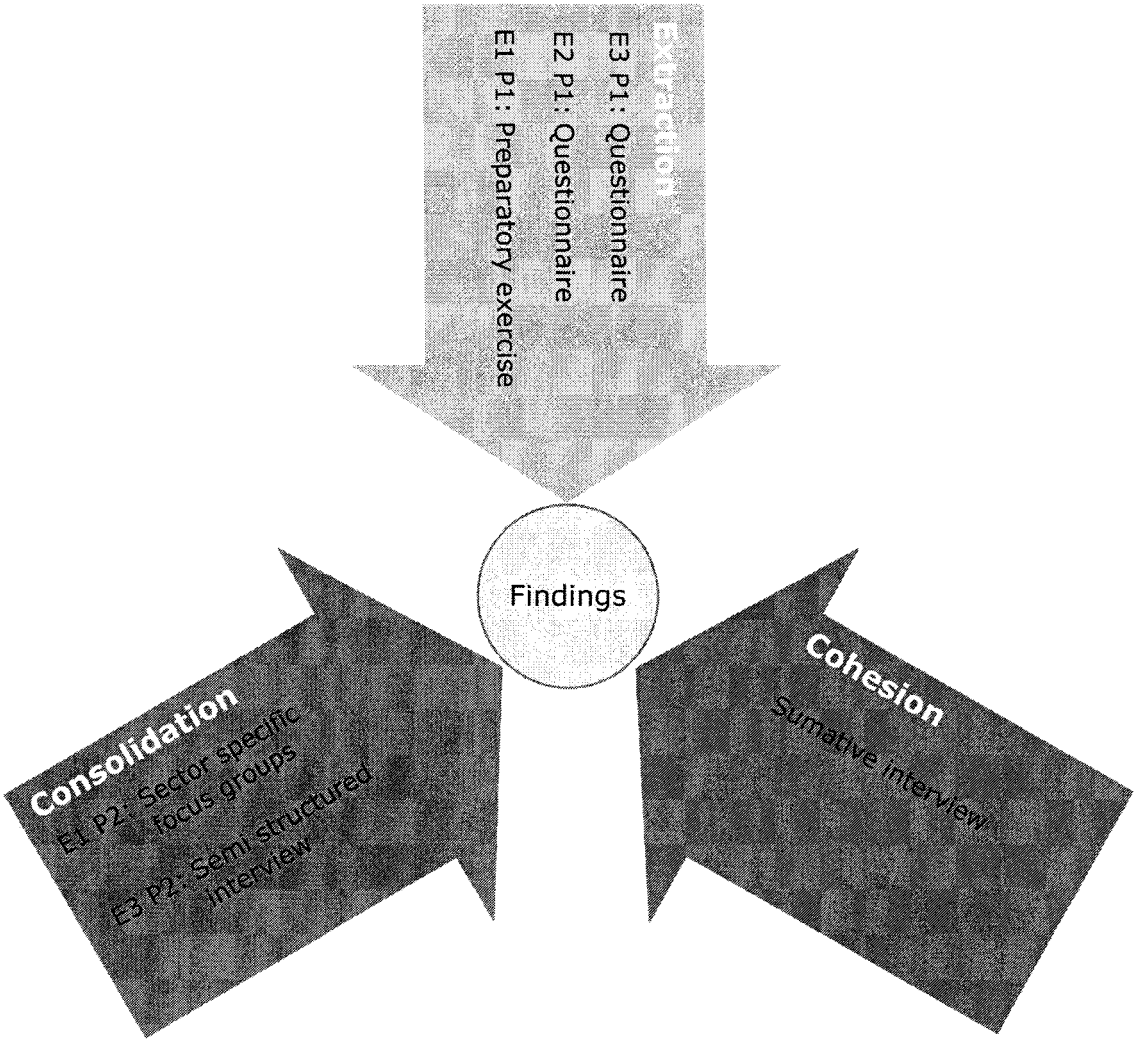

Figure 5-1 Convergence of data collection phases

5.2 Reflection on findings from extraction phases

This section is comprised of findings from the extraction phases of the research. It outlines and considers the data obtained within E1 P1, E2 and E3 P1.

Identification of the critical information gained during the extraction phase of the data collection is vital to gain the maximum from the research undertaken. Whilst considering the process of analysis of the questionnaires and exercise, it was understood that the findings from some of the questions have a greater relevance to the research outcomes than others. Therefore, appropriately detailed descriptions of those issues considered more pertinent to the final research outcome will be presented in the main text of results, whereas the findings from questions not considered as relevant to the main text are available within the tabulated results tables in the appendix 8 and 9.

5.2.1 MSME preparatory exercise: E1 P1

There were two principal components within the preparatory exercise, a section in which respondents were required to personalise a series of word lists, and also a section where representatives were required to generate a process diagram for their area of specialism and an overview of the clothing sector. A version of the exercise can be seen within appendix 4.

This element of the research was undertaken in the North East region, a diverse selection of individuals working in clothing industry sectors relevant to the research programme were approached. Therefore the findings from this stage illustrate a variety of opinions, obtained through individuals in different roles across a selection of companies. This approach gained insight and perspective combined with varying levels of understanding and knowledge of industry practice.

The first component of the exercise required the respondents to add words, or 'aspects' as termed in the distributed sheets. Aspects were added if the participant considered they were missing from the supplied list, yet relevant to the particular area of specialism. Once they considered their list to be complete, the respondent was requested to indicate those terms they considered to be key to the given process specialism (design, manufacture, market, technology). The second component required the completion of two process diagrams, included to elicit a further visual representation of their more specific understanding of industry process. The intention of this exercise was for respondents to externalise their knowledge in an intuitive and creative way.

5.2.1.1 E1 P1 word list summaries

The tables below have been generated to show at a glance the words that were compiled in E1 P1. However, more detailed tables illustrating the total count can be seen in appendix 5. These tables show the numeric summaries that derive from a more detailed spreadsheet used whilst the data was being compiled. The format adopted listed each of the 18 respondents across the top of each column, with the words listed down the left. This configuration allowed words that had been added by more than one respondent to be accounted for along the appropriate row, with the count function in the right hand column to total the frequency.

The findings from each of the lists will be discussed in order of process specialism in order to identify any common themes, ambiguities or words/aspects that were included or not that could imply limited knowledge or understanding.

Design word list – An additional 32 words were added to the original nine that were provided as a basis for the design sector word list. As can be seen in table 5-1 the words added were varied; design, production, quality through to travel and research trips. One notable exception to this list is 'consumer', suggesting that the six respondents asked for input had not considered the consumer relevant when asked. However the term 'customer' had been added, which within this instance was interpreted as the company they were designing for. Referring to the summary table in appendix 8, the numerical content in the right hand column illustrates the instances where words were added by more than one participant. Interestingly, other than fit, only fabrics and samples were added more than once. Further consideration of the terms added, such as commerciality and costings shows that there is an awareness of commercial acumen within the field of design practice. Also the inclusion of terms relative to production such as critical path and sealed samples indicate designers are aware of their role within the industry process.

Table 5-1 Design sector word list

Original words	Additional words		
Colour	Ability to travel	Innovation	Research trips
Computers	Back-up team	Job Satisfaction	Review
Inspiration	CAD system	Key customers	Samples
Past products	Commerciality	Launch	Sealed samples
Pattern blocks	Costings	Location of mfr	Seasonal
Pattern grading	Critical path	Pre-production	Sizing
Styles	Deadlines	meetings	Socio-economic
Target customers	Detail	Production liaison	(World Cup)
Trends	Development	Quality	Source Swatches
	Fabrics	R&D	Trims/accessories
	Fit	Research - books,	
	Heritage	magazines	

Manufacture word list – There were a further 38 words added to the original ten provided as a starting point to the manufacture process specialism, generated the most over the four compiled lists. Again as can be seen in table 5-2 below, the words added were various, which implied that the areas considered to be relevant to manufacture ranged from design and performance, to quotas and right first time. As with design,

there was a notable absence in terms of the consumer, with the furthest stage in the product lifecycle indicated as being the delivery schedule. More relevant to manufacture it is significant to mention the number of terms relative to developmental process that were added; continuous improvement – Kaizen, critical path, key performance indicators, lean manufacture and quality assurance. Each of these terms imply that those participants that still manufacture, or are at least in part involved in manufacture are aware of current practices. Another aspect to acknowledge are the words that were added referring to international considerations; offshore, overseas duties, overseas freight and quotas, the inclusion of which suggests that regional companies either produce or are aware of the terminology associated with overseas production. In terms of frequency of choice within this word list, quality was added five times advocating that it is considered an important aspect. There were only five other words that were listed more than once; critical path, design, lean manufacture, pattern grading and supply-chain, all of which are varied with no apparent theme. On the whole, the words compiled within this list gave an informed representation of the manufacturing sector, however the inclusion of the consumer would illustrate a more balanced understanding.

Table 5-2 Manufacture sector word list

Original words	Additional words		
Deadlines	Achieve delivery	Health & Safety	Quality
Finished goods	schedule	Key performance	Quality assurance
Machinery	B stock	indicators	Quality control
Operators	Consistent	Lean manufacture	Quota
Planning	Continuous	Location	Ratings/Utilisation
Production lines	Improvement –	Margin	Right first time
Quantities	Kaizen	Objectives	Skills shortage
Raw Materials	Costings	Offshore	Supply-chain
Seconds	Critical path	Overseas duties	Team work
Size ratios	Delivery	Overseas freight	Transportation
	Design	Pattern grading	Turnaround
	Efficiency	Performance	WIP
	Fit	review Price	Work Study
	Forecasting	Problem solving	
	Good communication		

Market word list – To the original twelve words, a further 28 were added, these can be seen below in table 5-3. Unlike the design and manufacture list, the extra words referred only to post production stages of the product lifecycle. Within the list there

were reiterations of words, where variations were given such as customer feedback, segmentation, service as well as relations management (CRM) which reassuringly indicates that the customer is a key consideration. In terms of frequency within the list, there was only one word that was added more than once which was returns. As with manufacture there were a number of references to international considerations; different markets – Europe, Asia, export, international and sales agents, which suggests that there is an appropriate level of awareness within the market sector.

Table 5-3 Market sector word list

Original words	Additional words		
Availability	Best product possible	Export	Returns
Consumers	Buying behaviour	International	Sales agents
Internet	Collections	Niche	Sales reviews
Location	CRM	Packaging design	Service
Outlet	Customer feedback	Planning	Supplier sell through
Profit/loss	Customer segmentation	Point of sale method	
Retailers	Customer service	Price	
Sales	Delivery performance	Price architecture	
Size ratios	Different markets - Europe, Asia	Promotion	
Stock	Discerning attitudes	Ranges	
Targets	Evening in house sales	React to customer	
Trends		Repeat business	

Technology word list – Starting with a list of thirteen, only eleven terms and phrases were added to the technology list, making it by far the list with the lowest level of engagement (see table 5-4). Terms added included the generic CAD and CAM commonly used across all product related industry sectors. There were also more specific terms that are particular to individual companies involved in the study. There were two words with a frequency of three, PDM which shows that there is one organisation using this facility, the other is KEA system (a company based operating system), again most likely a term used within one particular business. The limited content of the list implies there is a restricted knowledge base in this area, which is linked to the level of understanding, implying that technology use within the participant organisations is nominal. This brief list reaffirms is the realisation that technology knowledge and use within regional MSME businesses is minimal.

Table 5-4 Industry specific technology word list

Original words		Additional words	
Communication	New processes	Bestsellers	Lack of synchronisation
Computerised cutting	Pattern grading	CAD	Logistics
Data storage	Restrictive	CAM	PDM system
EPOS	Stock control	Difficulty	Store communications
Expensive to access	Under utilised	Fast react planning	
Highly technical	WIP System	Ideal stock	
Large data capacity		KEA system	

Compiling the sector specific word lists was undertaken to gain an insight into the current terminologies used within the sector relative to the four chosen topics. Throughout this section where the usage of words has been considered, there are terms of similar meaning that appear to bear the qualities of universals (Comrie, 1981; Clegg *et al.*, 1999), being added to the list by different group representatives. The value of obtaining this insight will enhance the understanding of the interrelationships being investigated using the process mapping. The results obtained from the four industry components have identified a number of areas to consider further;

- The broad scope of the words added
- There is little consistency apparent
- There is limited knowledge of technological phraseology

5.2.1.2 E1 P1 summary of diagram content

To view all of the diagrams discussed within this section, the sheets used in the E1 P2 focus group can be seen within the appendices; appendix 6 shows the sector overview diagrams, where appendix 7 illustrates the industry representative models.

The diagrams were created to obtain a representational sector overview of processes undertaken within each sector and the way they consider the industry to exist. Since each diagram was generated by an individual, their own interpretation of the instructions, combined with the application of their own insight into the simplicity or complexity of the industry, twenty-two unique resultant diagrams were generated. The intention of the summaries is to further consider and attempt to quantify this uniqueness. Further into this chapter the diagrams will be further considered as

industry representatives were also asked to contemplate and discuss the anonymised outputs within the three homogenous focus group sessions.

From an analytical point of view the diagrams were considered using a systems thinking approach. Therefore the decision was made to consider each model objectively, looking at the process from an outside perspective (O'Connor & McDermott, 1997, pp 143) since they had been created subjectively by respondents with personal knowledge of the process. Each of the diagrams showed an individuals perspective showing that within a given sector there were variations to the content and the layout. To aid analysis, the content was broken down into individual elements and components. The details extracted from the diagrams are shown below in table 5-5. What this matrix offers is a numeric analysis of the diagrams, with the summary line illustrates the differences in diagrams as a percentage, making it possible to effectively summarise the format of the diagrams;

- tend to be complex rather than simple
- have many rather than few components
- the diagrammatic form tended to be neither linear or cyclic
- the majority illustrate linked components
- the indicated links tend to be one way

Table 5-5 Complexity analysis of diagram content

		Simple	Complex	Few components	Many Components	Linear	Cyclic	Neither	Linked	Un-linked	One way link	Two way link	Neither
Design	Sector	1	5	1	5	2	2	2	6	0	2	3	1
12	Industry	1	5	1	5	1	3	2	5	1	3	2	1
Manufacture	Sector	4	0	0	4	0	2	2	3	1	1	2	1
8	Industry	2	2	2	2	1	0	3	2	2	2	0	2
Market	Sector	1	4	1	4	4	1	0	5	0	2	3	0
10	Industry	2	3	2	3	2	1	2	5	0	1	3	1
(No. Diagrams)		11	19	7	23	10	9	11	26	4	11	13	6
30													
% of total diagrams =		37%	63%	23%	77%	33%	30%	37%	87%	13%	37%	43%	20%

Detail complexity Dynamic Complexity

With reference to table 5-5, the two shaded sections of the table have been highlighted to illustrate two themes of complexity analysis (O'Connor & McDermott, 1997, pp 13). Detail complexity accounts for the number of components within the diagram, the higher the number of elements, the more complex. Whereas the dynamic complexity illustrates the actual links between each element, whether the elements are linked, and if direction is indicated.

An additional component of the diagrams was the text and terminology that had been used. A tool devised by the researcher for use within the focus group session was a sheet entitled 'how many times', which was a tabulated summary of the words that had been added. As with the word lists some terms were only added once, others a number of times, this table visualised this information for the focus group members. Within appendix 8 a summary sheet has been included to show the terms that were added that had a frequency greater than one. These frequencies will be referred to within the diagram descriptions.

The following paragraphs provide explanations of diagrammatic content adopting the systems thinking principles, using a standardised activity model to identify and interpret the diagram content (O'Connor & McDermott, 1997). Also terminology use within the diagrams and an overall interpretation of the group of images was considered. To ensure this analysis is undertaken in a consistent way, the sector diagrams followed by the industry overviews will be considered in the order of design, manufacture then market;

Design sector overview – Six diagrams were obtained, illustrating varying levels of form and complexity with most having a higher number of components. Links were indicated on each diagram, with five illustrating the direction of the process or relationship. Visually, there is a variation in form between linear and cyclic, with one showing no recognisable form. Feedback loops were incorporated into three of the diagrams. The most commonly used term, with five occurrences was inspiration, followed by design. The overall interpretation of the form and detail of this set of diagrams suggests that designers have an informed understanding of the process they undertake, as well as having the ability to translate and articulate their knowledge into this visual form.

Manufacture sector overview – Identification of respondents from a manufacturing background to complete the preparatory exercise was challenging, resulting in only four

diagrams being created. One of the four was very rudimentary in form, almost just an ordered list, with no links indicated, the other three showed a more indicative view of the process. Two diagrams illustrated a cyclic approach, incorporating an obvious feedback loop. In the variety of terms that were used, the most frequently referred to was manufacture/production followed by development and feedback. When considering the content of the diagrams, references are made within the diagrams to processes prior and post manufacture, illustrating an understanding of the additional stages within the product lifecycle.

Market sector overview – There were five visual representations of the market sector obtained giving varying illustrations from relatively simple to more complex. The form tended to be linear, with two diagrams suggesting the inclusion of a feedback process. Reassuringly the most commonly used terms were consumer and trends, both elements that form the basis of a successful market (Jones, 2002). The content of each diagram infers that the product is considered by the market sector from the conception stage, and that there is an awareness of each of the stages from design to sales.

Prior to explaining the content of the industry overview diagrams, it is important to reiterate the task that was undertaken. This of all the component tasks within E1 P1 was the element the researcher expected to require most thought in preparing, as in some instances the participant would be responsible for undertaking their job as a specialist and not be required to have a working knowledge of broader industry practice.

Design industry overview – Of the six diagrams obtained to illustrate understanding of industry processes from a design perspective, five offered a very detailed interpretation of the process. Only one of the six was very simplistic, three words in an order with no links indicated, the others offered more detail with numerous components, more complex forms, intricate links and feedback loops. The most commonly used term was design, market(ing), manufacture and sales, offering a well rounded understanding of the key processes undertaken within the clothing sector.

Manufacture industry overview – In comparison to the set of diagrams from the design sector, the four obtained from the manufacture sector were significantly more simplistic in form. Two diagrams were in the form of lists, whereas the remaining two provided a very linear interpretation of the process. The terms most commonly used were

manufacture, dispatch/delivery, material, plan and quality, suggesting that when asked to consider the overall industry processes, there appears to be a focus retained towards the manufacturing element.

Market industry overview – Of the five diagrams, two were very simplistic, with the other three offering more detail. Links were indicated in each diagram, with five of the six giving direction to the process, also two feedback loops were incorporated. The most commonly used terms are manufacture/production, design and retail. These terms are similar to the interpretations obtained from the designers, again suggesting there is an informed awareness of clothing industry sector processes.

Analysis of the findings obtained through the process maps was undertaken in order to consider all aspects that had been incorporated into the content. Perceived to be an effective way to gain insight into individuals understanding of a process, there were a number of factors that have emerged that are illustrative of the results;

- There are many interpretations of the same process
- There appear to be few similarities between the diagrams
- There are different levels of articulation between respondents knowledge and their ability to visualise it

5.2.2 Technology providers' questionnaire: E2 P1

This portion of the text will refer to the findings that are illustrated in a tabular form within appendix 9.

The data compiled through this questionnaire will illustrate to the reader the extent of choice of technologies and specification of technologies available to the sector. The content of the questionnaire, as can be seen in appendix 4, queries the provider to give an indication of the technologies they supply, at which stage they would generally expand on the further configurations that could also be possible. This illustrates that if a potential user was to approach the providers, that the identification of products to meet their needs is unlikely to be a simple process.

The researcher approached this element of the data collection from an academic point of view, and not as a potential user therefore no specific question related to product capabilities were asked.

As a precursor to the formal questions, each of the seventeen companies were asked to outline a number of business related information. The company names are provided in the results tables within appendix 9, with further more detailed company profile details shown in appendix 15. Also shown is the country where the business is based, four from the UK, nine from other European countries, three from the US and the last from Israel. In addition they were asked about the number of clients they had, three had less than 100, seven had between 100-500, five indicated greater than 500 and two were not indicated. The final question was asked to identify the size (small, medium, large) of their principal customers, four stated that more than 50% of their customer base were SME's, three indicated they were mainly large, three stated that it varied and seven did not indicate.

The radar diagram shown below (figure 5-2) was created from the Excel spreadsheet containing the findings from this question, a variation of this table can be seen in appendix 9. What is provided is a visual representation of the number of seventeen businesses that offer the different facilities; Design & Product Development showed twelve, Retail eleven, Sourcing, Logistics & Transport had seven, Information Technology ten, and finally nine for Manufacturing Technology. In the majority of instances providers offered multiple facilities, which meant that they broadened their target market. Even within this sample group, the findings propose that the businesses within the sector appear to offer a variety of facilities within their product range.

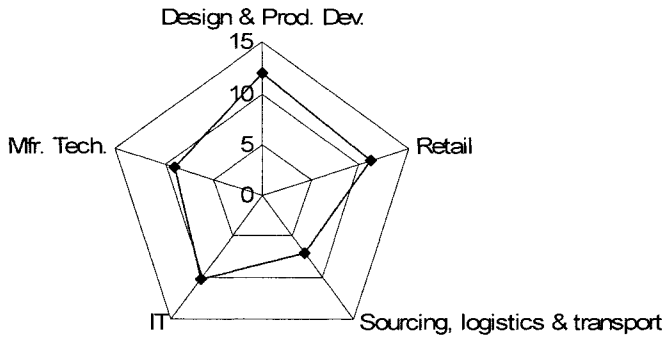

Figure 5-2 Technology products supplied by the providers

Providers were questioned about the availability of a 'lite' (Wikipedia, 2007b) version of their system. In this instance, the term lite has been used to refer to whether a partial

rather than a full version of their program/service/facility were offered. In total, 53% stated that they did offer one, suggesting that there is a likelihood that less costly, or lower level specification products are available.

Gaining opinion relative to the providers' interpretation of system complexity was critical to the wider context of the study, as ultimately if MSME businesses are to be encouraged to use technology, then it is more effective to promote facilities as being easy to use. Again within this section, a number of the participants made more than one indication of agreement, generally if the provider considered their product to offer a combination of complexity. The results, as can be seen in figure 5-3 below illustrate that 70% of the providers consider their products are simple to use, which would be a powerful tool to tempt and encourage potential end users

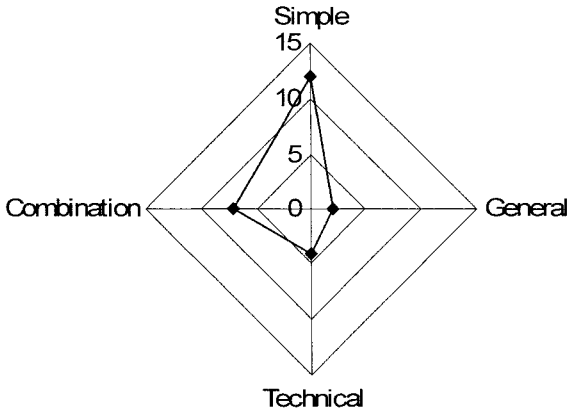

Figure 5-3 Indication of ease of use as stated by technology providers

Further consideration of the findings illustrated in figure 5-3 raised the issue as to why only 70% of the users stated their products were simple to use. This simple to use issue was noteworthy as from a potential user's perspective if a facility is classed as anything other that simple to use, there is the association that additional costs related to training will be incurred. This also led to the consideration of the way the respondents understood the terms used within the questionnaire. As it had been designed to be quick to implement, the terminology used within the questionnaire was thought to have been straightforward, but there is no way in which to interpret how simple or technical a respondent might mean, as their reference relates to their previous experience.

Identifying the principal source of sales generation was of particular interest. Having researched this area in preparation, the researcher had an inclination that recommendation played an important role due to a realisation that advertisements for this type of industry specific technology were limited. The diagram shown below in figure 5-4 illustrates that within the seventeen companies questioned, 75% cited recommendation as their main source of product sales.

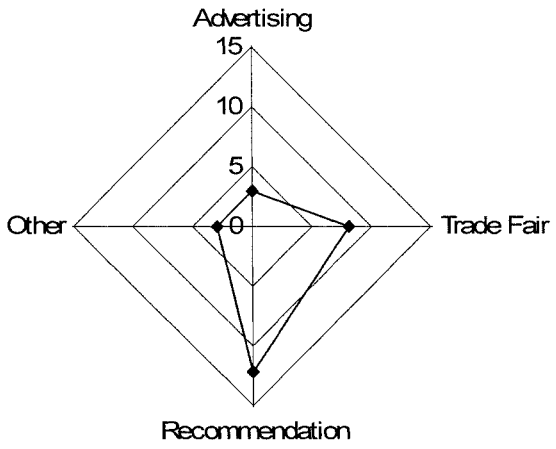

Figure 5-4 Illustrating principle sources of technology sales generation

As with figure 5-3, the results illustrated in figure 5-4 also warranted further consideration. Again the terminology used within the questionnaire was utilised to gain an indication of the participants understanding of the sales practice, the intention was not to be subjective, but to offer a number of options with the opportunity to state alternative means. As 'recommendation' was identified as the most common form of sales generation, how that term could be interpreted has been considered; within a business environment where personal or business practice endorsement could be offered; industry wise facilities could be advocated due to providers being market leaders or renowned for their best practice; also the level of customer service illustrated could influence commendation. In hindsight, gaining a further understanding of there being different interpretations behind each response suggests that there would have been opportunity to attempt to elicit further information with more refined questioning.

The final question was included to gain an indication of costs of the technology systems. However, the participant completed it only at their discretion. The cost associated with the adoption and implementation of new technology is often cited as a deciding issue when choosing to invest. Eight of the seventeen businesses did offer

indications of entry level pricing for their products. The table illustrating the findings of question 6 within appendix 9 shows that the prices were given both in Euro and £ sterling. These prices range from approximately £400 for a developmental electronic measurement device, to £80,000 for a highly technological, very advanced facility. Providing these figures illustrated that there can be a significant difference in price between suppliers, however no specific outline of the products these price indications would realise was provided.

Undertaking this exercise provided a valuable first hand insight into how technology providers consider the products they provide. An indication of the trends in product types that were available, whether variations of the full package would be offered, perceived levels of system complexity, main source of sales generation and finally approximate indications of costs of facilities were all obtained. Each of these insights could only be gained through direct contact with the suppliers in questions, and understanding the messages received through the findings will illustrate the issues faced by potential end uses within the MSME business sector. There were a number of issues that emerged from the findings that illustrate the current situation;

- There is a great deal of choice of product types and specifications from many different providers.
- These products tend to be poorly promoted, often to a limited audience.
- The technology that is not very accessible, due to the providers approach to sales generation.

5.2.3 Retail sector questionnaire: E3 P1

This section outlines the findings from the final element of the primary data collection phases, in which the high street retail sector were approached to provide the technology users context. The results obtained from this phase have been compiled within appendix 10. Of the original seventeen companies approached, responses were obtained from four. The analysis of the results from this section will comprise of reference to levels of agreement or disagreement with statements shown in tabular form in appendix 10 and where appropriate using radar diagrams within the text.

To incorporate an element of continuity between the data collection processes the first component of the questionnaire queried the retailers to indicate the types of technologies they used, using similar indicators as were used to query the providers.

The term 'innovative technology' had been incorporated in this instance in order to gain insight into any developmental technologies that may be being used within the retail sector. The responses, illustrated in figure 5-5 below show that there was a balanced spread of product types being used by the high street retail sector. The participants were also asked to indicate the suppliers of the technology they used, a detailed list can be found in the table compiling the findings for question 1b Suppliers of service, within appendix 10.

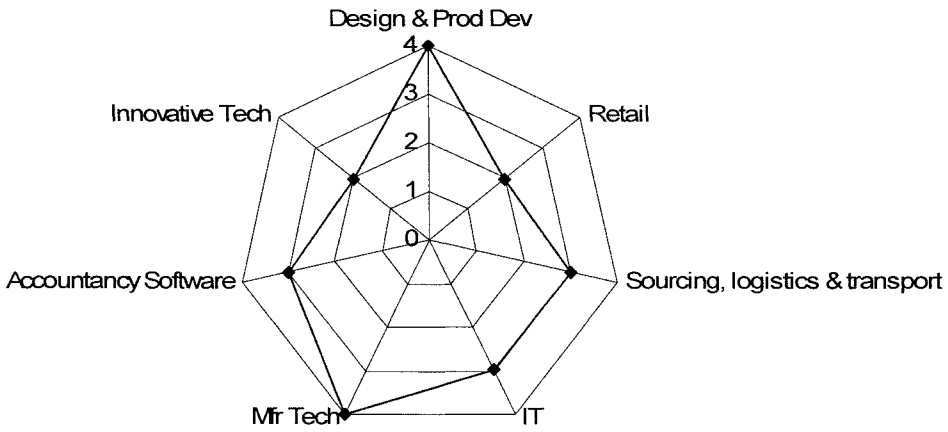

Figure 5-5 Technology products used by the retailers

In terms of the use of technology, participants were asked if the systems they used were integrated, the findings from 1c in appendix 10 shows that the consensus was that 'some' aspects were. When the diversity of technology which were being used for many different processes were considered, this response only gave an indication as the question did not ask the participant to specify which systems were linked.

When asked if the suppliers used had to have compatible systems, there were a variety of responses. The comments obtained from the participants are illustrative of the situation;

> Suppliers only need compatibility with accessing their order details
>
> This company is too small to demand suppliers buy their software. The same goes for sewing machines

The first shows that compatibility is required when dealing with orders, whereas the second suggests that as a smaller company they do not have the influence to implement compatibility.

When asked about the ways that technologies are identified, as can be seen below in figure 5-6 the responses did not indicate any clear preference. Also when looking at the results table for question 2a, the first respondent indicates that they actually use all the options, in addition to internal systems that are in place. As the results did not identify a consensus of approach to identification, this raised the issue of how to identify an appropriate method for potential MSME users.

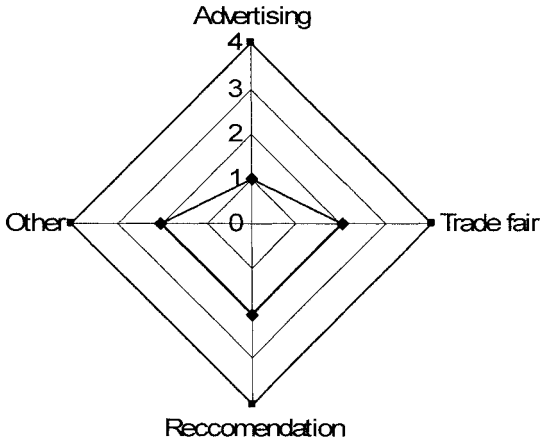

Figure 5-6 Ways in which retailers identify new technologies

A question was also included to identify if investment in technology was dictated by the financial budgets they all agreed. When purchasing technology facilities for large organisations the costs incurred are likely to be significant, especially if training and user licenses come as a pre-requisite.

The final section of the questionnaire was dedicated to the use of the SizeUK digital bodyscan dataset. The questions were devised to query how the data had been used: had its use reduced numbers of garments returned to manufacturer; the likelihood that its use would improve the provision of garments to the non-standard market; and finally whether their involvement in the survey was worthwhile. The responses did not indicate anything particularly positive or negative, but as the issues were also discussed within the subsequent interview this topic will be covered in the following section.

5.2.4 Retail sector interview: E3 P2

This element of the research was incorporated into the study as a component to follow on from E1 P1 with the aim to contextualise the initial research focus of technology use by the MSME sector. Using the findings from the four questionnaires conducted in phase one, five interviews were conducted as there had been a further expression of interest made to be involved with the research.

The intention was to utilise semi-structured interviews to identify how the large retail organisations integrated technology use into their individual roles. The interviews were completed within a month of each other, with the first two on one day, the third on a separate day and the forth and fifth also on the same day. Following the first two interviews, reflection on the content was undertaken in order to identify further questions that arose and considered pertinent to the study. Where these questions identified further issues relative to the clothing industry sector, they were noted down and asked in subsequent interviews. The instances where the outcomes were considered to be relevant to industry these subjects were developed.

Due to the range of areas covered the findings obtained from E3 P2 will be broadly considered, following the structure of the interview content, full versions of the partial transcriptions can be viewed in appendix 11. The analysis undertaken was fairly rudimentary as the findings from this stage offered relatively prescriptive answers to the questions posed. In addition, the content of section 3 within the interview was incorporated to query the respondent on their organisations involvement in the SizeUK survey. Due to the focus of the study shifting from the use of the data compiled in the SizeUK survey, only the findings appropriate to the study will be highlighted.

Within the introductory section that was formulated as an icebreaker, each participant was asked to give an indication of the length of time they have worked within the sector, the responses ranged from 10 months to 22 years. Respondents also outlined their previous experience which included pattern cutting and grading, manufacture, teaching, textile technology to quality control. This level and breadth of experience suggested that the findings obtained give a suitably representative view of current practice.

The questions that followed were devised to elicit insight into the workings of their business. When asked to explain their position within the organizational hierarchy and the interrelationships that exist within their organisation, one of the respondents

sketched out a diagram, which can be seen below in figure 5-7, which the researcher found remarkably similar to what was required of the MSME businesses. The diagram illustrated a relatively straightforward family tree style structure where the main organisation existed (to the left), and an offshoot team is outlined within the circle. The text in black was provided by the respondents, with the lighter text were notes added by the researcher whilst listening to the interview. In terms of participant roles there were no real trends that emerged in terms of the structures described; two worked within teams of technologists, some within complex team structures, whereas others were quite straightforward;

> Works with seven technologists below her, covering Clothing, Accessories and Home wares. The management hierarchy above her; Brand Director, 2 x Buying Directors, Merchandising Director, Merchandising Manager, Buyers (Assistant to Senior), Merchandisers (Assistant to Senior), then Technology works alongside
>
> Three main departments, Technical, Development and Design. In Technology they oversee production through the factory, QC follow up, warehouse audits and monitoring of returns
>
> Buying, merchandising, technology all work together as a unit, which is supported by design

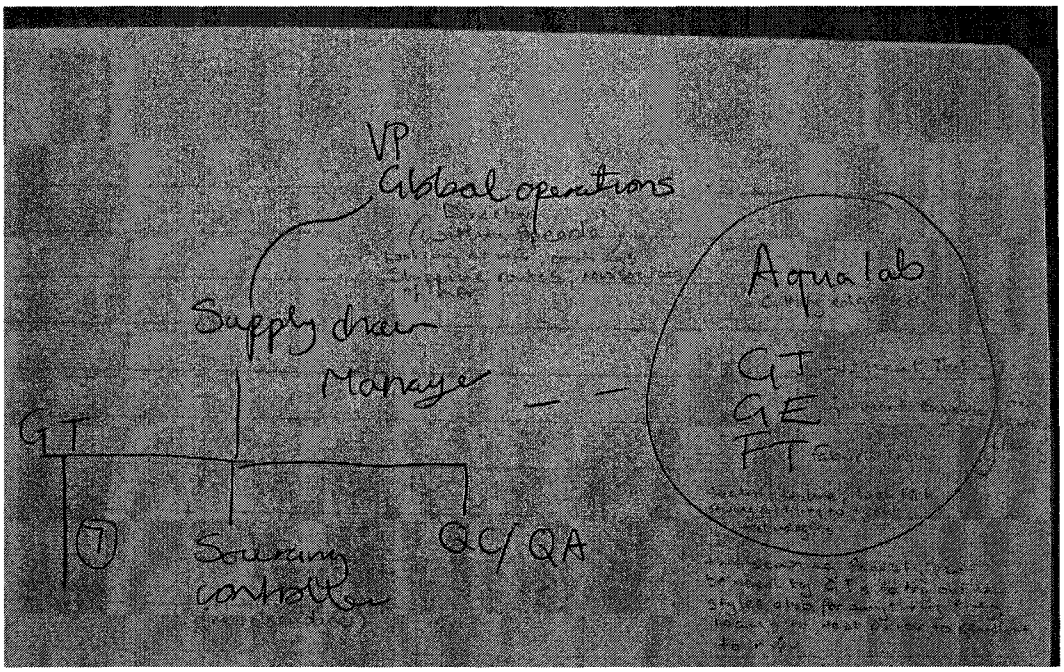

Figure 5-7 Respondent illustration of organisational hierarchy

This apparent disparity of internal organisational structure reflects a conversation held with the respondent who created the diagram, in which we agreed that it was common for "similar roles to have different titles". This is an issue that was apparent to the researcher prior to the study and therefore ensured that when a title was mentioned that was not recognised, a relevant explanation was requested.

The first issue to be queried was the stage at which the garment technologists handover the product, and at that stage who would take responsibility. Again the responses to this question did not provide a clear indication, with the responsibility of products allocated to different roles dependent on the organisation;

> Buyer is always responsible for the product, any fit issues are the responsibility of the garment technologist, if there are major issues then the fit technologist is involved, and in some instances the fabric technologist also
>
> Once the garment is sealed it is handed over the to the supplier in the factory, then it becomes the responsibility of the supplier to manage the system
>
> The term they use is 'cross functionality', once range review is completed by the Designers, they pass it on to the Technologists, who complete the product specification, it then goes to the Product Manager, then it goes back to the Designer to confirm what they are going to be making is what has been designed
>
> Stays with the team right through the lifecycle, right through to the RTM's. They pride themselves on their quality
>
> Designer, Technologist and Buyer work together until the garment is sealed, standard is agreed with the supplier prior to production, they make pre-production samples and agree to make to that standard.

These responses illustrate the inherent complexities within the product lifecycle during the stages between the conception and initial design through until the garment reaches the market. As an extension of the third response (above) the same respondent also created a visual representation of this transition, this can be seen below in figure 5-8. The annotation in the top right hand corner 'SS08' indicates that at the time of the interview, June 2006, the company in question were working on their collections for spring, summer 2008. This diagram illustrates how product progresses, and how the different departments and roles impact on the process. The term 'cross functional working' has been adopted within this organisation to reaffirm to staff members the importance of working across functions.

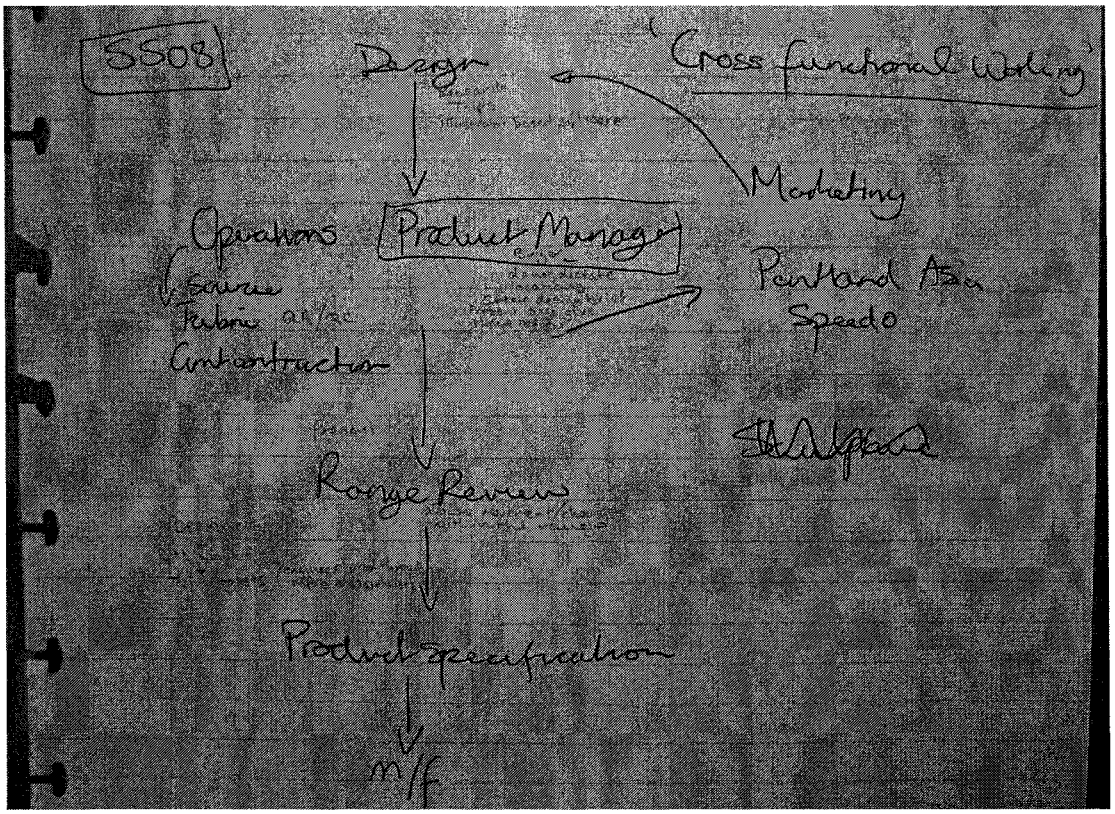

Figure 5-8 Respondent illustration of product progression and handover

Due to the nature of the subject areas being discussed, a number of additional questions emerged relative to the roles of garment technologists. Within the clothing sector the garment technologists hold a very responsible role, often working with many different internal parties. One of the questions that came about related to the supply of technologists into the industry, to which there were a number of differing responses, most of which illustrating a pessimistic slant;

> There is a constant pressure within industry, making it difficult for the trainers to train new technologists.

> There are still good people around, in 10 years there could be an issue. Not many college leavers being taken on as the work is at such a fast pace. Not enough time to change. Aim to retain staff and recruit people with experience. It is an aggressive environment

As these comments come directly from industry representatives, and show there is an underlying sense of apprehension. From personal work-based experience, the researcher understands that the knowledgebase required and preferred, for the role of garment technologist comes about through extensive experience. It was source for

concern that a number of these senior technologists interviewed, held similar viewpoints.

Within these discussions education and the provision of graduates as a source of technologists for the future were also referred to. Again, there appear to be underlying issues that must be acknowledged and would warrant further investigation outside this area of study;

> Many graduates don't realise the diversity of the roles that they could go into. Very diverse. Lecturers seem to becoming more aware
>
> Most graduates want to design.
>
> There is a void in terms of provision, seems to be a lack of technology courses
>
> The general standard does not seem as it used to be, expectations of the graduates often hyped by the university both in terms of finance and the role

Coming from a university based educational background, and progressing into a private sector manufacturer, the researcher was able to relate to the comments made. More specifically, these issues reveal aspects that illustrate a need to address the provision and scope of the content of technology, clothing and fashion design based courses.

The first main section of the interview was devised to gain an overview of IT use within the retail organisations. The responses obtained through the questionnaire, are outlined above in section 5.2.2.1. The findings show that there was no real consistency or prevalence in the choice of industry specific technologies used. One noticeable exception to this statement was that there appeared to be a trend for companies identifying suitable solutions for individual tasks rather than rely on one system to do all things.

In the role of the technologists it is apparent from the responses that they use identified technologies only to a limited extent, which relates to a comment obtained during the previous stage of the interview;

> Further up the management levels you go, the less contact you have with the product

This limited contact with the product suggests that there will be little need to use the relevant technologies, only to the extent that they have a working knowledge of the systems in place.

There are positive and negative issues associated with technology use, and rather than ask the respondents to list the benefits, it was considered more informative to query what they considered to be the issues associated with use. Although the respondents were asked to identify the negatives, positive comments came through, illustrating there is a need and a place for technology. The issues that arose;

> In some cases it stifles creativity

> The Internet based system they use 'see-folders' (in-house terminology) you have to rely on people to keep it up to date, but it is not too bad

> Speed, everything is so fast, sometime the industry specific technology is not quick enough. Often email is quicker. Capacity is also an issue. They are considering moving to a browser based system. In addition, if suppliers do not have the capacity on their mainframes India/Thailand struggle the most. She mentioned how development of industry specific technologies is much slower than consumable technologies, and as an industry you have to work with what is available

These comments do illustrate that there are issues related to technology use that affect the individual, in this case the creativity of the designer. The other comments relate more specifically to the technologies that are devised to store product data, and the responses infer that there are also issues associated with those, such as keeping information up to date but also more specific capacity and problems with usability. The final question in this section queried whether the use of technologies removed the need for practically skilled people. The consensus was that it did not.

The second section focused on the business considerations involved in technology use. When queried about the ways budgets are compiled, and as garment technologist what input did they have on the process;

> They stay aware of new technologies, if they did find something they considered to be relevant, a business case would be generated as part of a formal process

> The updates are limited and minimal, as a business they don't get too involved, as the system is used group wide

> Strongly involved. She has an annual budget, gave an example of a specialist printer that is being considered for purchase in the future

Consideration of these responses shows that different organisations have different agendas and priorities in terms of technology procurement. Referring to the final comment above, this relates to a remark made at the beginning of the interview in which one of the respondents explained that part of her role was to;

> Identify new technologies, either software based or new physical manufacturing technologies such as sewing/bonding

This response was very valued by the researcher as by involving the end user in the identification of technologies gives informed consideration to the investment. This showed that an awareness within the sector of the different functionality and capabilities of the technologies as well as the advancing manufacturing facilities.

When asked about the way technology affects working relationships different opinions were apparent;

> Technology helps, especially with communication around the world, anything that clarifies and speeds things up is good, even the fax

> There has been a recent influx of designers, but garment technology has stayed the same, this makes communication difficult with the increased workload

> Yes, web PDM is an interactive tool, buyers and technologists have to input, buyers set up the packages, style codes, packaging information, technologists work with the fit comments, so yes, it is used across functions

The common theme to the responses relates to the communication either between individuals, within a team or between customer and supplier. What is apparent from questioning these organisations about technology use is that each individual appears to have different expectations of what they want to do, and how they go about doing it. Technology is present within large organisations at different levels, from the use of the humble digital camera or fax machine to state of the art product data management systems that can be accessed at any time, from any place across the world.

The final section of the interview was based on each of the organisations involvement with the SizeUK survey, which was a deciding factor in determining the respondent group. This element of the survey is not as key as it was when the interview was undertaken, there are areas covered that relate to the wider context of the research.

When questioned whether the data compiled within the SizeUK survey was relevant to their organisations target market sectors, three of the four stated that it was. Each of these responses offered a different reasoning to the use of the online database;

> Yes, definitely, it reaffirmed the findings made by their organisation (they are still involved in bi-monthly meetings with SizeUK)

> Yes, data can be chunked as to what you need

> Yes, they do use the database, they have pulled information off (but she did not work on the actual project). The data is not just used on a standalone basis, it is used in conjunction with other information and technologies

As the formulation, compilation, processing and availability of the SizeUK data has been studied for a number of years, it was important to see that this powerful resource was being utilised by those who were involved. However, there was one response that gave a very different perspective on the question, it appears that this company do not use the SizeUK website as a resource for the size data, as their customers like the current fit of their garments;

> Interesting, but their consumers shop with them as they like their fit, so it is relevant to a degree. They do use the data to an extent.

Respondents were asked whether involvement in the SizeUK study encouraged involvement in any other developmental research projects, two said no, but there were three who said yes;

> Have been speaking to Bodymetrics about the development of a generic model for all the SizeUK partners

> As they are fashion driven, they want to be involved in new things, it could be the 'thing' that makes a difference. As nothing new has come along, they have not been involved

> Yes, they have had contact with Bodymetrics as they are launching an 'Asian Fit' for China and India. Due to religion they have different requirements, breast padding to stop nipples showing

Again the research has revealed that these positive responses present opportunities for future development within the industry.

In summary, the experience of entering these large organisations with a specific research agenda was fascinating, to see the internal workings of what could be

considered to be high street institutions. Prior to gaining insight into these high profile organisations it is difficult to avoid generating preconceptions relating to the way they 'might' conduct business. Understanding the complex and hectic ways in which the industry exists there was an inclination that each of the companies approached would use state of the art industry specific technologies to monitor the vast numbers of products within their ranges. This was not entirely the case, as three of the five businesses used the types of technologies that were expected, whereas the other two did not. One primarily used a combination of Windows based software, a newly introduced design package and an up to date website for their retail portal. The other organisation used a bespoke facility supplied by a provider not commonly associated with the clothing sector, who was very dated in terms of current capabilities. However, this very well known high street organisation illustrated almost a split personality since their website, accessible by the consumer is state of the art, yet behind the scenes there is a very dated system with capabilities far more limited than the technologies devised specifically for the sector. Understanding that there is an inconsistency of facilities used within the sector illustrates that if an organisation is happy with the capabilities of the systems currently used they tend to continue with that rather than undertake the upheaval involved in updating.

When considering the amount of information gained from the retail sector relative just to the area of technology use, it is apparent that there would be many other areas that would benefit from further study. However, for the purpose of this research programme, the principal findings that relate to this area were;

- That technology is being utilised, to different extent and for different purposes across the sector
- The disparities in types of technologies used were substantial
- There were no consensus as to how technologies are identified
- Investment in technology is dictated by budgets

5.3 Reflection on consolidation and cohesion phase data

When conducting qualitative analysis a researcher aims to create order from the data obtained, in this case through semi-structured interviews and focus group sessions. Full and partial transcriptions from the interviews and all components of the focus group sessions formed the basis for the qualitative data compiled during the consolidation and cohesion phase of the research. In order that the analysis was

undertaken effectively, a coding formula was devised to identify key themes emerging within the transcription data.

Reading and re-reading the transcripts identified further detail within the key themes, and once coding began it became apparent that many statements offered value to two, or more themes. Below, table 5-6 outlines the framework that developed within the initial phases of the core data analysis, which identified 12 areas that were divided into more detailed sub-groups. The decision was made to use the NVivo, a qualitative analysis software package that aids the processing and refining of data. The documents containing the transcripts from the interviews and the focus groups were uploaded into NVivo so that the text could be electronically coded. The document coding was based on the themes outlined in table 5-6 which ensured that the analysis undertaken would follow a structured approach. Use of the NVivo software facilities greatly enhanced the task of identifying and acknowledging the links that formed during coding and also in discovering overlapping links between the topics discussed as the analysis progressed.

Table 5-6 Initial approach to qualitative analysis coding framework

Themes in findings	**Detailed coding**	
Consumer	Culture Expectation Issues	Practice Wastage
Design	Approach Different disciplines Education Filtered down	Forecasting Issues Philosophy
Diagrams	Agreement Approach Choice Content Cyclic Finish	Interpretation Linear Links Reflection Relationships
Industry	Development External industries Issues Practice	Process Problems Roles Trade shows
International	Contact Influence Reference	Manufacture Shows
Key issues	Consumer Customer Design Development Ethics Globalization Government agency	Industry Manufacture Market Recruitment Sizing Technology Terminology
Manufacture	Approach Commitment Development Forecasting	Issue Offshore Onshore Quality
Market	Brand development Brand loyalty Brand sustainability	Branding Niche Strategy
Media	Fashion magazines	Trade press
Method	Diagrams Terminology	Words
Retail	Branded fashion Experience External influences Fashion High Street Issues Practice	Pricing Problems Product quality Specific Strategy Supermarket
Technology	Adoption Implementation Issues	Problems Transfer Value

It is intended to illustrate and discuss the findings of this study by devising a theoretical framework by which to show the macro story (Golden-Biddle & Locke, 1997). However, as the analytic process progressed, there was a realisation that the level of detail first applied when coding the data set was far more than the requirement of this study. Therefore, using a heuristic approach to identify the key elements, allowed the coding already applied to be further refined into sub sections that were more relevant to the research subject. The original coding themes (nodes) within the documents were kept as they did not affect any further analysis, and could be accessed at any time if further investigation is required into any more specific issues.

Once it was identified that a more focused approach to the analysis was required, the twelve themes outlined in table 5-6 were filtered to identify the themes most pertinent to the analysis. This process has been visualised in the diagram shown below in figure 5-9 illustrates that the researcher considered the key issues that emerged relating to 'technology' and 'industry', and also pulled together the comments relative to the 'word lists' and 'diagrams' in order to identify a consensus in choice. The term 'method' was also incorporated as the comments made were considered relative to the focus group method would inform any subsequent studies undertaken within this sector, or in utilising this approach.

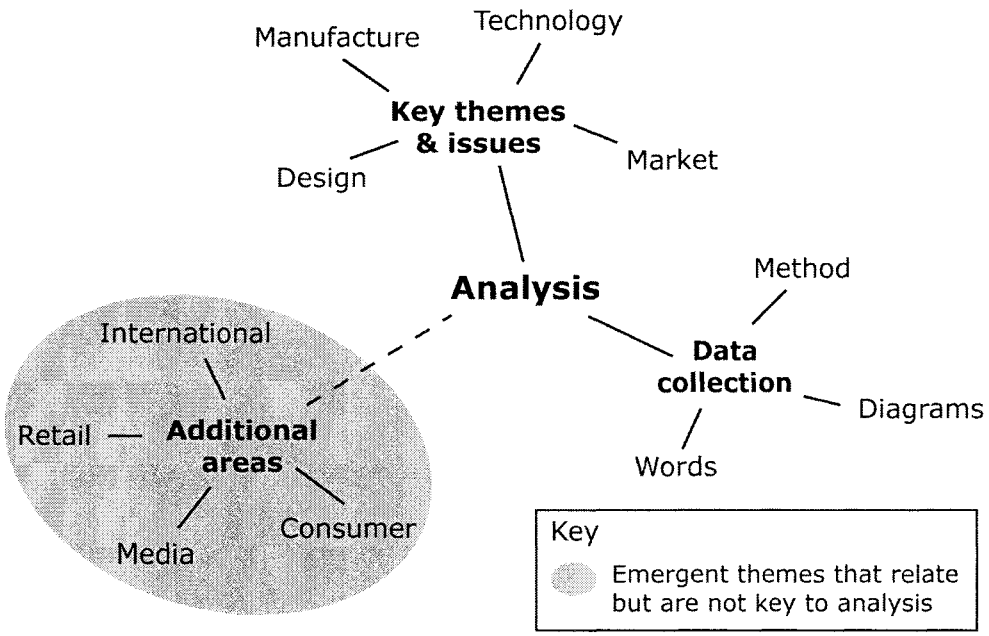

Figure 5-9 Further refined approach to data analysis

Once this more realistic approach to the analysis had been identified, the process of analysis was undertaken with more relevant outputs.

5.3.1 MSME sector focus group sessions: E1 P2

The following sections outline the findings obtained during the focus group session, including the round robin exercise, the discussions based around the word list and diagram choices, and also the comments received through the critical incident questionnaire distributed after the session.

As the qualitative element of the research is based on transcriptions, discourse was selected as examples of the findings that will illustrate to the reader the passion and dedication shown by those industry representatives who were involved in this stage of the research programme. It is hoped that the outcomes effectively demonstrate participants thoughts relative to data collected earlier in the research programme will illustrate the issues that are faced currently by the sector. As you read through the following pages, it will become apparent that certain comments generated significantly more emotive responses. Comments of this nature which represent a more emotive response, illustrate underlying issues which are more pronounced or sensitive.

5.3.1.1 Round robin exercise

Forming the standardised component of the focus group exercise, the comments (C1-C5) were distributed at the beginning of each of the homogenous group sessions. The complete textual responses can be seen in appendix 12 by sector group. After each participant was given a designated time to add a comment onto a sheet of paper, the comments were considered and then discussed within the group. The findings shown in this section have been taken from the focus group transcripts at the stage where the comments were discussed, therefore suggesting that the issues identified are aspects that could occur across any of the design, manufacture and market sectors.

C1 Potential gains to be made through the use of technology within the clothing industry MSME's are...

> I think that technology plays a large part, I know from my experience that when I first started working everything was faxed, things like patterns and embroideries were faxed over to China. You used to have to stick everything together and cut and paste them, they would nearly always shrink 5%, so then you would have to blow it up 5%, then a sheet would be missing!

> When we all [businesses] started out on this road of cost reduction, which we did, we followed along with the car manufacturers, and the white goods manufacturers, we realised that if we wanted to continue to sell our products, have a UK base for our products whether we are manufacturing or not, then we would have to start and allocate cost reductions, which involved the use of technology.
>
> Various things have been written, but I mean the whole thing with technology in this industry, it is not rocket science, is it? The only way that this industry can compete, is not on producing things at the lowest cost, because China will do that every time [agreement], therefore with technology, we have to look, the story of Britain really, we have to look at niche markets, with a higher profit potential.

These comments outline the feelings within different sectors about the use of technology, in some ways it creates obvious benefits especially in relation to communication, in others there is a suggestion that there was an initial reluctance to change, and finally that use of technology has enhanced opportunities within the UK for niche market products.

C2 Other than outlay costs, the factors influencing an organisations decision to invest in technology would be...

> Technologies were introduced with the sole purpose of getting cost reductions, it was sold to us by the technology people and we embraced it. What we have done is facilitated a global market place, as we now have worldwide email communication, we have data sharing files that offer open access..., there is no barrier to it whatsoever, no barrier in terms of the size of the files you are sharing, in terms of the complexity, in terms of the efficiencies and the ethics of that trade of information.
>
> Other than the outlay costs, I suppose the obvious one is who within my company will be able to use this equipment, do they need training, how will I cover that person, how will I maximise the benefit of the machinery/programs. It boils down to a cost benefit analysis at the end of the day, even if the initial outlay is very small, there will be a stage where the company needs to access will it bring the bottom line profit using that equipment, would it make it quicker or more efficient. Again, I think it is very much around the training and implementation of the equipment, that is quite important.

The first of these comments does not so much identify why they did not invest, but there appears to be an underlying message that for them it was a requirement for them to be able to run an effective international business. The second comment addresses a number of issues that could ultimately affect a decision to commit to an investment.

C3 The most annoying thing about high street clothing fit is...

> The most pertinent thing here, is it seems as though design is literally being 'lost in translation'. Literally, it seems as though you can go from what is an amazing concept, that is beautiful and stunning, then it is cut down so much that it buyers think 'I can't spend that much on that', resulting in it being cut down, it becomes another 'same' garment, which is the common theme that runs through these comments.
>
> In regards to high street clothing, as it is something that we [as a company] see day on day, and week on week within the shops. There are some very specific items here, where people have touched on the quality aspects, and the finish of garments. There is an extremely good point that has been made that it [high street clothing] is predominantly made overseas, which is a plain fact that inevitably affects us all [as manufacturers], so it all starts rolling. There is another good point with regards to the cheap prices, yes, I am sure that as consumers we like that aspect of things, but the impact that it is having on us [as manufacturers] as a whole, in terms of the industry that we are in, is not so good as well. So, that one, as with others are all very pertinent, there is just a common theme there with regards to making abroad and cheapness.
>
> One of the points that I put onto the sheet was not meant to be facetious, where I mentioned that the problem with the high street was the rate of change. I did not mean niche markets, I meant fashion garments. I was recently reading where the turnover of fashion, like your daughters wardrobe [to MFE], it is just the norm now. People are just going out and spending £50 on half a dozen items, wearing it, then throwing it away. The landfill, sorry I can't remember the figure, but it was immense, something like 2.5 billion [inaudible] a month of the turnover of stuff coming in from overseas, used once, dumped then going into landfill.
>
> There are a number of things listed, with people making the comment personal to them, as for a start I think it depends on how you shop. One comment is about 'cheap and nasty', so I am taking that as most peoples experience of buying on the high street is the garment is of poor make up, either poor choice of fabric, finish or seam quality. Another mentions the focus on the young market, with products being more casual rather than smart. There is also a belief that some are of poor design, we were just talking before the session about the level of copying from the catwalks that is currently taking place, where obvious copies are being worn, which will not have the same focus as the original garment. There is also a comment about the size variation, EU, US and UK sizing. The comment that I made in regards to running the risk in terms of volume, when styles lose their individuality when they are bought [by retailer] on mass.

The discussions relating to this subject came from many different perspectives, but the main theme that emerged was unhappiness with what was provided. Some of the issues mentioned above, were that: garments looked the same; designs were copied then filtered down; the often questionable finish and quality of the garments; issues relating to sizing; the cheapness; constant rate of change; which linked to the issue of landfill and the disposability of the goods. There were many areas that emerged from

this comment that could be discussed in much more detail, however they were merely issues on the periphery of the subject area.

C4 The area of clothing industry MSME businesses that would benefit most from the use of industry specific technology is...

> Basically everyone has said that the designer can concentrate on the designing, while the technology can do everything else, or at least help to do everything else. This means jobs are being done more quickly, so you could just have one designer and use the technology to grade patterns, to test the fabric, to the marketing and everything else.

> There is a list on this sheet that I could not add to. The comment that jumped out to me was technical sports clothing, I guess the reason that that jumped out to me, was in terms of technology, sports clothing is all about... people in this area are interested in the garments they wear enhancing their performance.

The discussions relating to this comment were quite limited and specific, so to supplement the discussion, textual responses were also considered, which can be viewed in appendix 12. The text based comments obtained from each sectors showed there were a number of common feelings; manufacture would be the sector to benefit most, improve live garment specifications, enabling documentation relevant to garments to be kept up to date, that benefits to communication could make businesses more like their larger counterparts.

C5 If there was a market for batch produced clothing goods in the UK how realistic would implementation be...

> I mean, that is essentially how I work, I produce small runs of garments, and I don't work to the usual sort of timetable, so I will not do like a 'spring' collection, I will literally make to order, so if a customer asks for 10 jackets, I will have a batch of ten made. So, rather than having to do say a run of 100, and hope that some of it sells, it is more the case that it is a custom ordering type of thing.

> If we [as a business] want to have a made to order garment, which refers to the batch statement [C5], that is ideal for us, batch supply and made to order are one off garments. We clothe everybody, regardless of their shape or size We have an enormously large size range, ladies from 6-30, but there is always somebody outside that, so batch would be great for us. The thing is that we can not get that done in the UK, at the price we can get it done in China. So we can use our pattern that has been digitised within minutes, in an afternoon, that is sent to China where it hits the production line and gets made. One thing we have not overcome yet is that it is then on the sea for six weeks [agreement, laughter]

Due to the sizes of the groups, this sheet was only handed out in one session, but where relevant was raised verbally during the group discussions. From the comments raised, it was apparent that batch production of sorts was already being utilised by two of the sectors (design and manufacture) due to the nature of their product range and customer base.

To summarise the principal issues identified by this element of the research to the research findings;

- It was identified that technology aided communication
- Also technology offered opportunities for international connections and to strengthen UK based niche markets
- Of all the sectors manufacture would benefit through the use of technology
- From an industry perspective there is a sense of disappointment in terms of high street provision, too cheap, too much change, poor quality

5.3.1.2 Word list findings

Forming a critical component of the research findings was the identification of a keyword list formulated from within the clothing industry sector. The words compiled within E1 P1 undertook a refinement process within the focus group sessions. Tables 5-7 and 5-8 shown below illustrates the words identified by each of the design, manufacture and market focus groups in the left hand column. Table 5-7 shows the three 'key words' identified by each group for each sector, with table 5-7 showing the additional words identified for their relevance.

Table 5-7 Word list choices made within focus group sessions

	Design	Manufacture	Market	Technology
Key words Design	Back-up team Innovation Sealed samples	Design Offshore Quality	Different markets - Europe, Asia Profit/loss Sales	CAM Communication Data storage
Manufacture	Computers Inspiration Sizing Trends	Achieve delivery schedule Quality Team work	Customer segmentation Different markets - Europe, Asia Profit/loss React to customer	Communication Fast react planning PDM system
Market	Inspiration Target customers Samples		Consumers Profit/loss Promotion	

Rather than describe the reasoning behind each selection, a process was devised to quantify and utilise the data in the table above. This data was transferred into a spreadsheet in order that the choices could be considered quantitatively. The choices were copied into a spreadsheet using bold formatting to indicate the keyword choices made by each focus group, then each of the lists were colour coded, design in red, manufacture in green, and market blue. Using the copy and paste facility a comprehensive list of all the words was created, then sorted alphabetically to identify which had been selected more than once. The compiled list is provided in appendix 5 under the title; Focus group wordlist choice analysis. Across the three sessions 62 words were selected, 24 of which by two or more groups. A further observation relative to the choice of words, involved the words chosen by two groups. The same choice was made by both design and manufacture 42% of the 24 occurrences, suggesting that there were very similar viewpoints between the two sectors.

Table 5-8 Secondary wordlist choices made within focus group sessions

	Design	Manufacture	Market	Technology
Selected words Design	Commerciality Costings Fit Inspiration Target customers Commerciality	Continuous Improvement – Kaizen Efficiency Fit Good communication Machinery Margin Size ratios	Availability Buying behaviour Customer feedback Customer service Location Niche Planning Price Ranges Service Stock	CAD EPOS Pattern grading
Manufacture	Colour Detail Fabrics Fit Innovation Pattern grading Styles	Design Efficiency Good communication Lean manufacture Objectives Quality assurance Right first time Supply-chain	Availability Buying behaviour Customers CRM Niche Price Ranges Service	
Market	Costings Computers Deadlines Fabrics Innovation Source Swatches Styles		Availability Location Price Sales Service	

Using frequency of choice of words to further refine the list of 62 words, those words selected two or three times have been compiled in table 5-9 below; there are 25 words in total. Looking at the table it becomes apparent that the understanding and expectation of technology is limited, and as the term communication was identified most frequently, and that was only twice, indicating there is a limited expectation of where the groups perceive the value to be.

Table 5-9 Suggestions for an industry sector keyword list

Design 9 words	Manufacture 5 words	Market 10 words	Technology 1 word
Computers Costings Fabrics Fit Innovation Inspiration Pattern grading Styles Target customers	Design Efficiency Fit Good communication Quality	Availability Buying behaviour Different markets - Europe, Asia Location Niche Price Profit/loss Ranges Sales Service	Communication

In order to identify words within the discursive text, those seven words that were selected three times; availability, fit, innovation, inspiration, price, profit/loss and service, were searched for within the transcriptions. However as most of the words were secondary choices, the only words that were discussed and therefore the only ones with accounts were innovation and profit and loss;

> For design, we thought that the first thing was to be innovative, which will also cover being inspired, and being aware of trends, so looking from a designer point of view more than a high street retail level.
>
> I think for design, it will be inspiration, rather than innovation, isn't it? To be fair, inspiration should incorporate innovation.
>
> The profit and loss, so you know what you are selling, and what is being received well, or not being received well, as well as what you are making on each [agreement]
>
> From the small enterprise point of view, if it is life and death, profit/loss. They say that turnover is vanity, but profit is sanity, isn't it!

On consideration of this part of the analysis, though the qualitative element gave a limited insight into the findings, the choices made that were noted down and analysed further illustrated the types of terminology used within the sector. One observation relating to the understandings of innovation as opposed to inspiration is that; an innovation needs to create change successfully, whereas inspiration may fail to develop. Therefore in relation to previous consideration of the word lists, the issues identified at this stage were;

- It was apparent that there was limited use of terminology relating to technology and its uses
- Terms identified for design, manufacture and market were fairly representative of current industry sector practice

5.3.1.3 Diagram selections

Within this section the findings being discussed relate to the diagrams that were selected within the focus group sessions as being representative both the sector and the industry. The choices made within the relevant groups are shown in figures 5-10 and 5-11, the text accompanying the diagrams was taken from the transcripts of the focus group sessions as the selections were discussed.

When considering the diagrammatic element of the data collection, there was an inherent ambiguity involved in both the creation and analysis of the final output. Also, due to the nature of the focus group environment, where discussions have a free reign, topics of conversation could be very disjointed. Therefore, where the discourse relating to the diagrams seemed relevant to the choices made within the session they have been incorporated into this summary of the findings.

There was only one instance within the three focus group sessions, in which one respondent acknowledged seeing the diagram that they created, and reassuringly the comment made suggested that they still considered it to be relevant.

Shown below in figure 5-10 are the choices made by the group participants, which they considered to represent the processes undertaken within their role or sector. The table shows that two choices were made by the design group, in which they proposed that the bottom diagram (D3) could be superimposed into the 'design' label incorporated

into the upper diagram (D4). Also shown are the choices made by the manufacture and market sector.

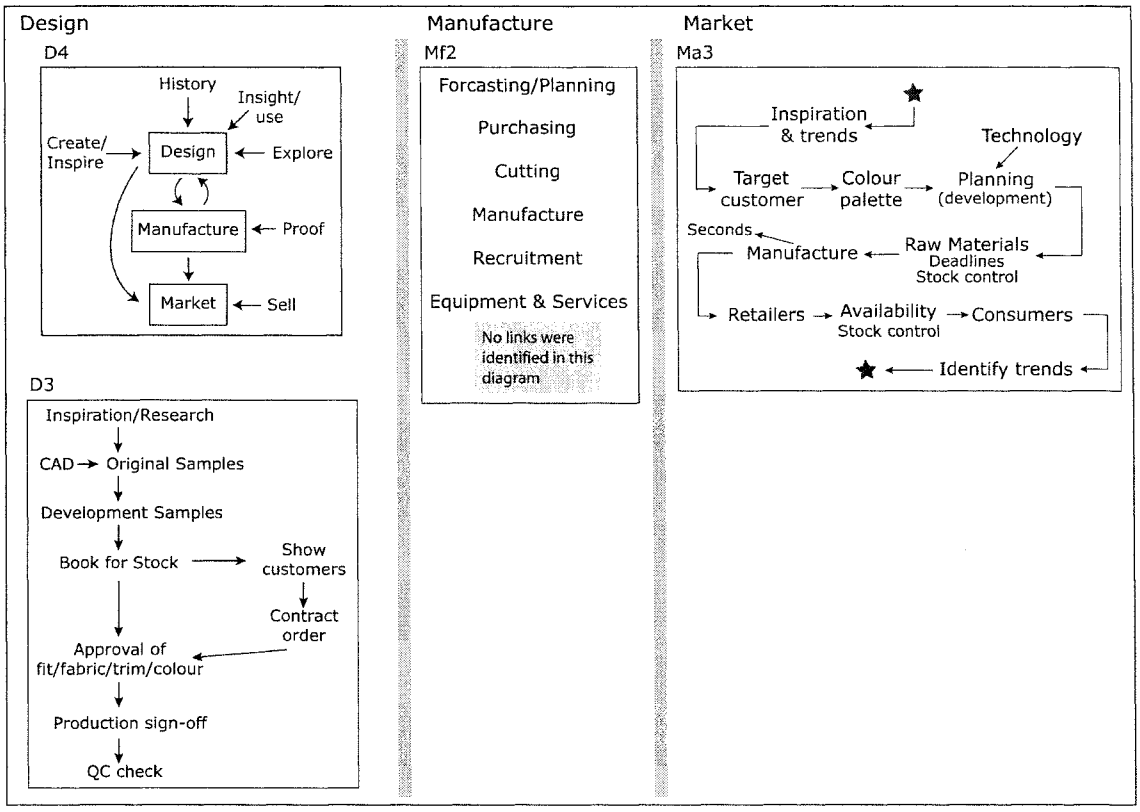

Figure 5-10 Focus group representative sector diagrams

The comments below relate to the choices made of the design diagrams, in order to contextualise the identified comments some references made to the other diagrams have been incorporated. Full versions of the sheets they were referring to can be seen in appendix 6.

> It is interesting where each of the diagrams finish as well. For instance, D2 starts at design being inspiration, and finishes with manufacture, it is also that is where they [as the designer] signs off, that is their dealing [agreement]. Whereas, even D3 finishes at the QC [quality control] check, out of their hands, but then actually D4 goes on to say sell it...
>
> I think I would put D3 into that design box [within D4], [agreement] to kind of bring out that element. Or even D2 into D4.
>
> This [D3] is very seasonal, this is what goes on in terms of repeating, two or three times a year.
>
> I think D4, I like as far as diagram, but not necessarily words, but the way that some things feed into other things, where as D1 it shows design as the centre

> there are all these things coming in, and then a collection is being put out, there is no manufacture, there is no attention as to whether the garment is going to be easy to cut, or grade, whether it is going to be suitable. It is very much, that is how a designer sees themselves. Whereas this one [D4] is, everything is feeding in [agreement], you know...
>
> I think on D4 I want to put an arrow from 'market' or 'sell' back to history [agreement]... I think that that one shows how design is used all the way throughout, not just in fashion design, but in graphic design...

The comments relating to the design sector appeared to illustrate an insightful understanding of the processes involved in the sector. They were also prepared to consider how the diagrams have been constructed, and how they might be amended or developed.

Below is a comment that was made directly relating to manufacture choice,

> Looking at these diagrams, I think that these do apply [Mf2], you can make your links wherever you want according to your particular flow, in manufacturing. Yes, there is an element of planning in the first place, but that planning is based on what you did last anyway, so there is an element of looking back at what you had done, forward planning and then implementing that forward plan, using whatever processes you have. Whether you have someone that is going for an off the shelf product, or something with an element of design in it, because not all manufacturers have design!

In this instance, the group opted for the most simplistic diagram available, it was basically a list, with no connections, links or directions indicated. This choice was made over more involved diagrams that further explained the processes undertaken. From the comment above, it appears that the group saw value in the ability to be able to add the links where appropriate. This also suggested that they were able to relate to the straightforward terminology and approach that had been used.

The comments below refer to the market choices. One diagram was selected from six that were provided;

> When you look at it, it has a star at either end, which means that it starts again [agreement], it is quite good, I think that it is probably the best, from my view any way.
>
> But going back to what you [to the Interviewer] said, it may need to be developed in order to be more of a circle.
>
> It is good that it is recognised, it just shows that it is an industry that is driven by trend, or the consumer creating the trend, or the consumer following the trend

[agreement], and as that is repeated, it is almost as if it is engrained on peoples thought somehow, isn't it?

These comments refer to the importance of the cyclic indication of the chosen diagram, but also the importance of the word trend that has been incorporated at what could be considered to be the start and the end of the process. Within previous stages of the analysis, the market sector tended to be concerned more with the post production stage of the product, this diagram however incorporates aspects from raw materials to the consumer.

In figure 5-11 below are the diagrams that were selected as being representative of the processes involved within the clothing sector. In this instance, two diagrams were identified by both design and market, whereas during the focus group session the manufacture sector were unable to make a choice. This is reflected in the comments identified below.

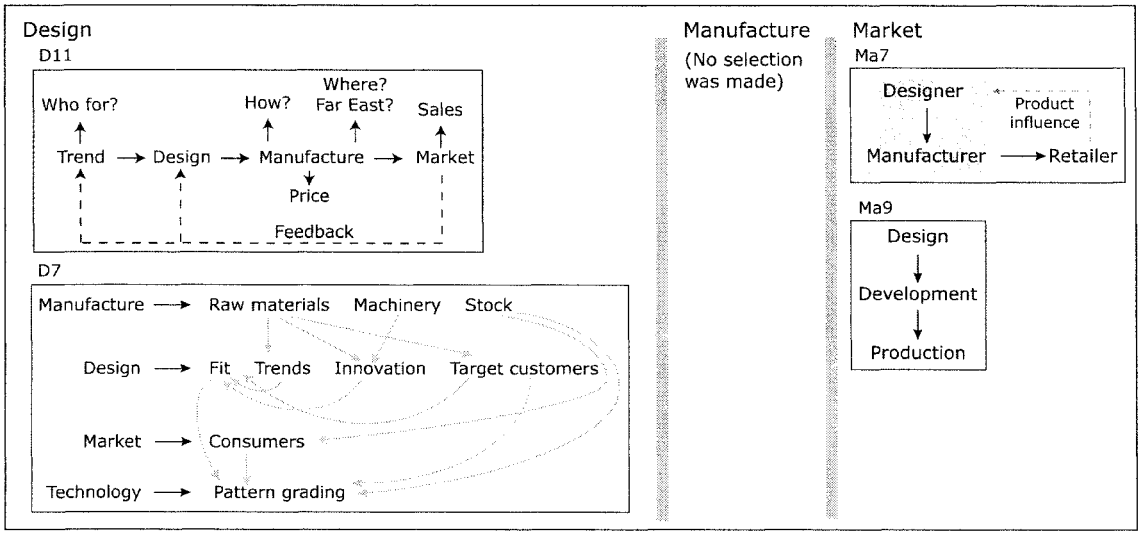

Figure 5-11 Focus group representative industry diagrams

These comments relate to the industry process choices made within the design focus group session;

I think that D11 is probably the clearest, but D7 shows how everything feeds into and out of, there is nothing in there that could be taken away, whereas this is, I don't know... It is very linear [agreement].

I was not sure if that was..., I want to put it into a cycle, so this is like a cycle that they are doing again, and again and again. It just does not quite fit.

> I think, that D10 seems too linear [agreement], you want to go back and...
>
> So it is like with D11, because they have got the arrows indicating links between, because that could indicate trends linked to market as well, the links could be...

The comments made by the designers reinforce the importance and need for feedback within the clothing industry process. Also they prefer to see links between the different elements.

The comments below relate to the market selection;

> The diagram MA7 does seem to have quite a good flow, in the fact that it comes back from the consumer back to the design process, so there is some return.
>
> Diagram MA8, is not bad in some senses, that is very simply the continuous circle, isn't it [agreement].
>
> In MA8 though, they do not have the consumer there [agreement], with the retailer as the location perhaps, or somebody that is presenting it, but you still have got to invite the consumer in.

The discussions held within the market group session were far more to the point that those within the other groups. From the choices made, there appeared to be a preference for more simplistic and straightforward diagrams, as opposed to the more detailed diagrams that were also considered. Again the value of a circle or feedback was stated, illustrating the importance of this factor in the choices made.

Whilst considering the discourse to identify the most appropriate quotations, there were a number of comments that referred to the diagrams, but did not have specific reference to the findings. In order to acknowledge a number of these issues, relating to content, approach and the way that the processes were considered, the quotations have been included below;

> So it suggests that the diagrams reflects the size of the business [agreement], as I can't identify who completed each diagrams. These diagrams, each time I talk about them it is refreshing, and I get new things from it. It is interesting to see that where they start and end relates to the size of the business, or the role of the person that was drawing the diagram.
>
> I think that these diagrams are more or less based on the acceptance, rather than rejection [agreement].

> Well, that person has probably just thought through, and just not shown the completion. Sometimes, you actually need to talk things through to actually get it down on paper.
>
> No, it is not a linear process, any manufacturing is not linear in many ways, I think those that have drawn these diagrams have done so to make them more simplistic. I think that this is a very circular type of industry [agreement], where there is response, feedback, market trends, response to trends, what has and has not worked, this has to be fed back to design, then re-designed, or re-worked, or changed [agreement].

Observing the discussions around the diagrams was very interesting, as some of those who had created the diagrams were present within the sessions, and none of them identified which was their offering.

As each individual has their own understanding of the processes involved both in terms of their sector, but also industry practice. This individuality adds an interesting mix to the conversation. It can also be detrimental if there is a group member that has particularly strong opinions.

Reflecting on this process has raised the issue as to how each sector would relate to the diagrams created by other sectors, would they be able to identify the origin, how would the interpretations of the industry overview be considered, and what would have been the overall choice?

After analysis of the choices made and the discussions relating to the choices, a number of common factors became apparent in terms of how they considered they should be;

- Incorporation of feedback into the process was considered to be important
- Cyclic rather than linear processes appeared to be favoured
- Formulating a consensus was quite an involved process

5.3.1.4 Further issues arising that relate to the research subject

The comments below have been incorporated to illustrate the wider issues that were discussed within the sessions. They were selected for their relevance to the subject area;

> I don't think that there is not enough jobs for the students that we produce in the UK. I think that there is also the question that the quality of the students...
>
> It has taken a lot of the innovation out of design, as most of the designers within the manufacturing sector, tend to be technical designers, and their skills are for making something that is a product. Let's face it, garments haven't changed very much, they still have two sleeves, still two legs in the trousers, still a collar on a man's shirt...
>
> The true innovation in design, does not really exist in manufacturing...
>
> I think that initially the UK was ahead of the game, it was ahead in technology, it is ahead in design still, but the competitors are not far behind now. That is the problem, we still need to be ahead of the game, in designing new software to do various aspects of design, the garment technology is still an aspect that we know more about than others.

These statements are only an indication of the many other issues raised, but they do illustrate some of the topics that were discussed which could affect the future development of the sector. Other issues emerged within the discussions relating to quality, with manufacturers questioning both the quality of high street goods, and goods produced for and by them within the UK. There is also the belief that good quality commands increased sales price, that style and status also influence purchases, this can not go on indefinitely, especially when considering current retail market trends. This in turn relates to consumers and how the current approach to clothing and its apparent disposability, comments were made that proposed increasing the cost of clothes the appreciation of the garment would raise. These issues are from a regional MSME industry perspective, but what was apparent is that these issues relate to the wider spectrum of the sector. The comments made within the discussion illustrated no significantly negative or defeatist comments, showing that there is still a belief in their products and services.

To summarise the comments that were provided above, there was suggestion that;

- Technology use has an appeal
- There is potential for opportunity through design
- There is an issue relating to employment of graduates, and to the suitability of education provision to the current industry

5.3.1.5 Follow up questionnaire

Conducted to get direct feedback from the focus group sessions, seven short questions based on the critical incident questionnaire model were distributed. The questions were devised to access individual feelings about the content and the application, also to illustrate the good points and how the arranging of future sessions could be improved. The questions, followed by the responses are shown below;

At what moment/s during the FG session did you feel that you were most engaged with what was happening?

> The open discussions were really engaging and I felt as though we were bouncing thoughts off each other as it was a small group it became more personal

> At all times, the topics were relevant to my understanding on industry and commercial practices. The session was wholly interactive, with appropriate prompts and exercises

At what moment/s during the session did you feel most distanced from what was happening?

> When we sat in silence and were asked to write answers to the questions provided – written words can be interpreted in many different ways and so I felt unconfident of my answers and more isolated than interactive

Was there anything that you observed, heard or experienced during the session that you found affirmed your views or helped your professional engagement?

> The similarity of views was re-assuring

> We seemed to have similar views on the fashion industry and how retailers present fashion – this was interesting as others backed up my thoughts with facts and their opinions. It inspired me to put more flair into the designs and not follow trend predictions so closely

> The industry has changed, but most organisations represented in the FG's were moving in a similar direction and the flow of communication and interrelationships across the company and the sector remain the same

What have you seen, heard or experienced during the session that found puzzling or confusing?

> I found I had little knowledge of how fashion design is conducted in other companies as I am not from a fashion design background although currently linked with this field, so I listened and took in all the information I could at the session then I researched further into this area. I feel this will benefit the way I work and may inspire new ways of working for me

Within the session what did you find most surprising or provocative?

> It was surprising how simplistic some people find their business processes

> Everyone's passion for their line of work – it really promoted emotive discussion. Also the requirement for creativity in the high street

> That organisations still 'stitch' [manufacture] in the UK

If you were to tell an industry colleague or associate about the FG session, how would you describe it?

> An interesting opportunity to compare views on priority business aspects

> A learning curve / a passionate forum discussing fashion design and manufacturing

> Well facilitated – good prompts and preparation. Useful forum to re-affirm thoughts. Useful forum to share good practice.

Arranging FG's designed to gain an industry insight was seen as problematic, how would you propose future sessions be arranged more effectively?

> I thought the FG I attended was well organised with props and everything! If you were able to set up a focus group at a work place it may be more intriguing for people to attend. Curiosity is a good seller!

> Breakfast seminars 8-9am via Chamber of Commerce or designated industry bodies like BCIA [for clothing]

The feedback received illustrates that those involved in the focus groups were very positive about the event, and the feedback they were prepared to give was very encouraging in terms of future research within this sector. Some of the things this feedback showed:

- Appears to be a good level of engagement
- Participants were encouraged by the similarity of views (across each design, manufacture and market group)
- That value was gained through attendance

5.3.2 Summative interview

This portion of the data was analysed qualitatively, using the coding strategy devised outlined in section 5.3. Also within this section, the respondent was asked to comment on the selection of words/terminology and diagrams made during the focus group sessions. The final selections will be illustrated accordingly.

As with previous sections, the wordlist choices were discussed first. Comments made were mainly in agreement to the choices made, but there were four proposed additions. These can be seen below in table 5-9, with relevant comments followed by the rationale behind the additions;

Table 5-10 Final review of word lists within summative interview – Missing words

Design	Manufacture	Market	Technology
Intellectual property	Balanced sourcing	Cost benefit analysis	Mass customisation

> They are so naive, there is a word missing from here... I can't see it yet, but I would have liked to see intellectual property. Because, what happens with designers, especially the new and energetic ones, reaching out into the world with their new avant-garde approach to things that is going to be the next years big earner, what will happen is mischievous organisations welcome them [the new designers] ask them to test out a few things [designs], then slightly change the design, plagiarise it and make a fortune with the designer left out in the cold.

> The word that I feel is missing from here is balanced sourcing, which is a particular way of saying, I am in manufacturing, I am going to source these things cost effectively offshore, and I am going to retain these, higher added value niche market goods onshore, for rapid response. That is the way that the manufacturing industry is surviving at the moment, everyone you talk to is trying to do something to make sure...

> Yes, cost benefit analysis is very important. Yes, because once the design is made, if it is not cost effective then it is pointless to make it.

> So where is Mass Customisation on this list? Really it needs to be somewhere within this list. Because MC is the ultimate in the area of rapid response, and as that is there it is important for you and I thinking about how to protect our

> markets here in the UK [agreement], but finding a way to get into MC does need to be on the agenda somewhere, that is what I would offer [agreement].

As illustrated by the comments made above, on review of the four wordlists the participant was able to identify key words that should have been incorporated in the given lists. Consideration of the additions; thinking about the current relevance of intellectual property across the board within design culture, that suggestion provided a valuable addition to a potential keyword list; the term balance sourcing was discussed within the focus group sessions but not identified as a term relevant to manufacture; the addition of cost benefit analysis was an important addition to the market sector list due to the practicalities that must be considered prior to the production of goods; the term mass customisation was identified as being missing from the technology list, which when considering this practice is being promoted as the 'way forward' in clothing production it raises questions to how aware they are. Each of the four terms that were added appear to be well considered, but obvious, they do however show that within the sector there does not seem to be adequate awareness of what could be considered as 'buzz' words within the specified fields.

One of the comments made in relation to agreement with the words that were added, was in relation profit and loss, and the fact that it had been identified within each of the focus group session;

> Everyone identified profit and loss which I am very pleased about.

The text below shows excerpts from the discussions relating to choices of representative diagrams made within the focus group sessions. If required, the choices can be viewed in section 5.3.1.3 whereas to see all the diagrams referred to see appendix 6 and 7. The comments that relate to each of the selection are as follows;

> So you do the market research first of all, then you end up with a design that you prove out... I like that word being there actually, then you might have to refine it, which is why the little arrow goes backwards, that works for me... This market research is important, that is why it says trends, that would be market research. The thing that almost got on the diagram, you see that word fabric... Someone almost thought about it... You need the word sourcing in, in a stronger way, within this model, because it is not just sourcing the fabric, it is

> sourcing yarns [agreement]. It is sourcing raw materials, are raw materials mentioned anywhere?
>
> Raw materials, machinery, stock, trends, innovation, target customers... I like D7 better, it is a more healthy interpretation... D7 seems to capture it, as all the key elements are there. The raw materials, the stock, the design, fit, trials [inaudible], the word technology is in there, which is critical... I feel I do not have to think about market...
>
> Mf6 captures it... It is the market place, then we design it, then we manufacture it. They have missed the selling chunk out of that, of course, I still maintain that even manufacturers... And this is why manufacturing is in decline, we have abdicated our sales and marketing skills to the retail sector!
>
> I can't disagree with the fact that this one [Ma1] works.

When considered in order these comments relate to overviews of; design sector, design industry, manufacture sector and market sector. The feedback referring to each of the choices illustrates that the content and the linkages indicated on the diagrams were considered and any thoughts relating to them were discussed. The comment referring to Mf6 was made as within the manufacture focus group they had not identified a choice to represent the industry. The diagram itself was a list rather than a process diagram that listed and outlined the processes in the order; market, design, manufacture. The comments made illustrate that there was agreement with some of the choices made, where the participant identified any amendments or an alternative choice, these are described are reviewed below.

As the interviewee reviewed the diagrams, there was only one proposed alteration, which was Mf2 that was selected to represent the manufacture sector. The comments made and the amended diagram, in (figure 5-12), are shown below;

> This model [Mf2] is too simplistic, I like the idea that they have the forecasting and the planning at the front end [agreement], because clearly market research is critical to them, and it should be taking place prior to the forecasting and planning [agreement], as you will not be planning anything until you know what your market segments are that you are going to target [agreement]. I would like to add the word sourcing alongside purchasing [agreement], so we don't miss the point here that purchasing might be those discreet capital investments that you make, in making sure that the buildings and the infrastructure is in place.

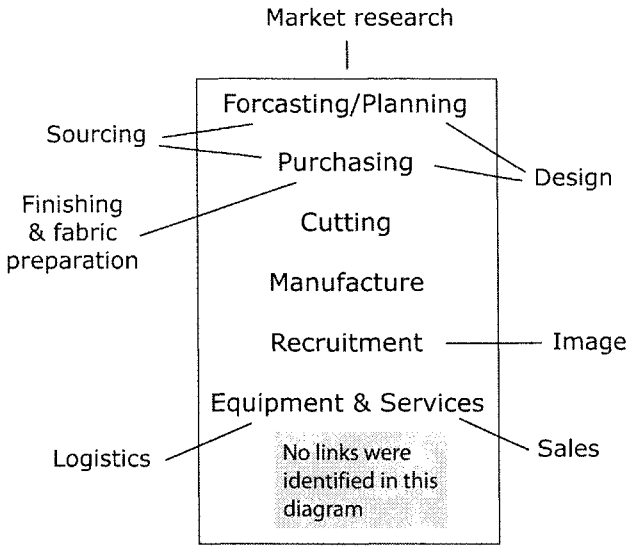

Figure 5-12 Amended version of diagram to illustrate Manufacture sector choice

When reviewing the diagrams selected by the market sector, the respondent stated he would have selected a more detailed diagram than the two simplistic diagrams that had been identified. The quote below outlines the rationale behind the choice, under which is the diagrams being discussed (figure 5-13);

> It was interesting the choice that was made from these diagrams, they bypassed the more complex ones, and opted for the simple representation (Mf8 and Mf9).
>
> If you use that diagram that over simplifies the process, how will other people see where they are?
>
> Unless natural mechanisms are in place, each department will work in silos...
>
> My choice would be Ma11 [the most detailed diagram], as it gives me more meat on the bones, so that is not to undervalue the choice made by the group, it is this language issue, if you use that diagram that over simplifies the process, how will other people see where they are? Or where they connect [agreement]. So, I think that would be a far better representative model. It even brings in the brands, retailers, the labour, that is a healthy process.

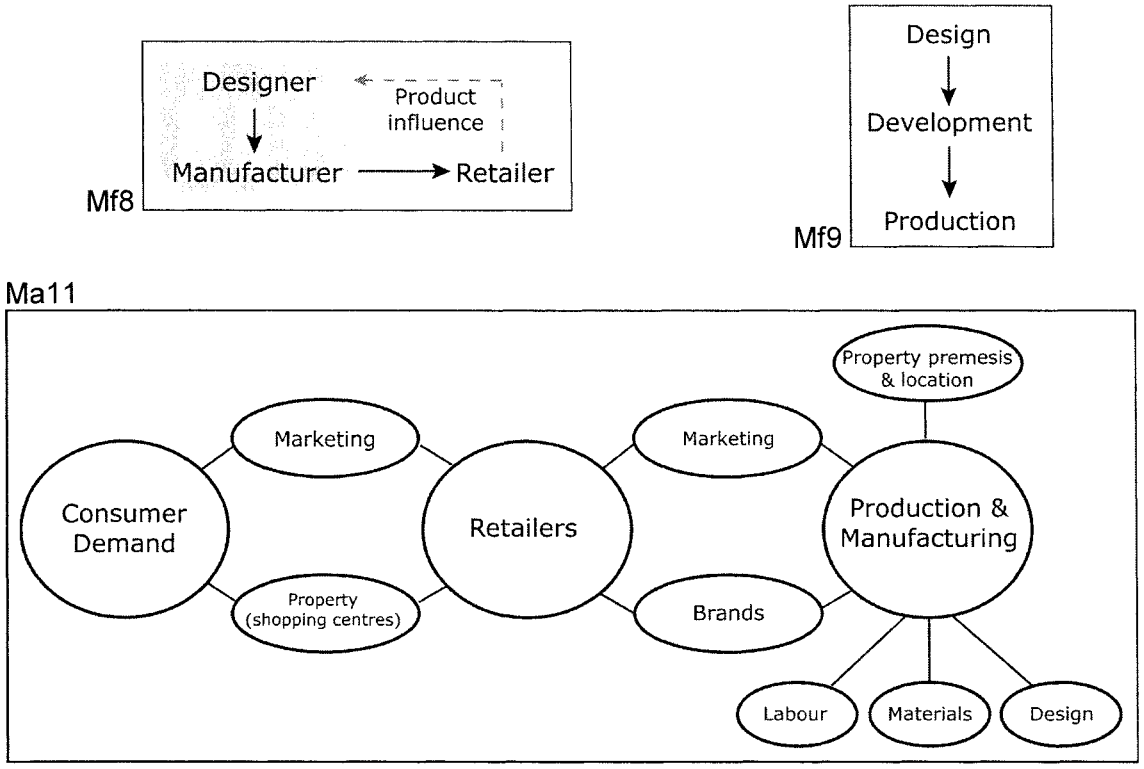

Figure 5-13 Alternate selection for market industry overview

The comments below do not relate to the wordlists or the diagrams, however issues were mentioned that were not directly related to the subject area, but are illustrative of the current industry climate and problems faced by the sector;

> With technology you have to find a way to make it cost effective at that level, or, get employers to work as a consortium where they could buy [agreement] one of it, and have a number of licenses off it. So, licensing agreements, looking at those prices, is one of the things to consider when marketing this.

This first comment shows that the interviewee and the organisation which he is affiliated propose there is value in technology acquisition through consortiums. This approach involves companies working together, which this research has shown is quite a rare occurrence. Within this sector, it tends to be the norm for companies to work in isolation, there is generally little natural interaction as businesses have concerns over keeping a competitive edge. Also there is the factor as to whether all companies will be prepared to offer this provision, and how feasible this approach would be in the medium to long term (Rowse, 2003). Therefore, if considered to be a viable option for MSME businesses, relationships and trust would be paramount to the process.

> As what you are seeing in the sector is that the government has such a wishy-washy approach to manufacture, as opposed to the service driven economy

This comment relates to government policies relating to the clothing manufacturing sector, with the suggestion that support of manufacture based businesses is not as prevalent as to the support provided to service economy companies. This comment relates to the discussion in section 6.3.5 in the way that in recent years there was significant funding in place to aid and enhance the sector, which is now being redirected to different economic groups.

> If you look at Ma2, that is the type of thing that I would like for manufacturing and marketing. If you could make that diagram work with manufacturing on the left, and marketing on the right with what happens in the overlap area in between, that is the thing that will half the problems of the economy for textiles [clothing] industry, because that is where it does not happen.

The comments above refer to one particular diagram Ma2, which can be viewed in appendix 6, and how the way it is presented could be applied to different sectors. The diagram in questions is in the form of a venn diagram, in which two overlapping circles representing warehousing and retail are shown with the areas of consideration between.

> Is this a copy that I could hold on to? I might want to share that with some colleagues, because of what we are doing with the design sector.

This final comment refers to work that Skillfast-UK are may relate to a program that has been introduced in line with the Sector Pathways Initiative, entitled 'Women and work' a self employed designers course devised for women graduates (Skillfast-UK, 2007). This interview was undertaken in November 2006, the document described was published in May 2007, suggesting that the diagrams being referred to could have aided the development process of this scheme.

Conducting the summative interview provided an opportunity by which to discuss earlier findings with an informed party. Gaining opinion on the selections made within the focus group sessions illustrated there were gaps within the knowledgebase and

understanding that were further considered during the analysis phase of the programme.

Chapter 6 Discussion

6.1 Introduction

This section will bring together the key points that have become apparent through the research process, the review of the literature, methodology identification and implementation, and generation and consideration of the findings. Reflection of the findings has identified details from within the knowledge base from which concepts have been derived in order to create a theoretical base on which to underpin suitable statements.

Within this section the approach will be to discuss the research outcomes in an order that builds a picture and understanding of the subject area. The discussion of emergent concepts and theories will be followed by an outline of issues which have faced, and may continue to face, different sectors of the clothing industry. Consideration will also be given to language and perception inconsistencies, particularly those of professional terminology and role used by different businesses and sectors. A section has also been incorporated that describes the benefits of addressing identified needs of the sector. The final section will review the approach to the programme of research, providing a critical review of the research and an explanation of its theoretical development.

6.2 Concepts and theories arising from results

The intention of the study was to understand why clothing sector technology was not being used more competitively. By considering the findings from each of the research elements individually, and then as a whole, it was expected that the predominant factors and concepts would be revealed, enabling the formulation of usable theories. When considered from a grounded theory approach, the identification recurrent concepts illustrated areas of theoretical relevance (Strauss & Corbin, 1990, pp 177). The key concepts that have been identified are the result of a process of continual refining approach undertaken whilst analysing the data. The following sections will explain the emergence of the basis of the theoretical concepts.

This section has been incorporated to discuss the findings obtained from the results chapter. The key findings summaries (to be referred to as common factors) from each section are to be discussed to illustrate their relevance. These common factors will

form the structure of the discussion around each component of the results in order that all key elements are understood prior to undertaking the theoretical analysis within section 6.2.4.

6.2.1 Extraction phase

The purpose of the research was to gain an understanding of current industry in order to identify ways in which could aid practice and development within the sector. As analysis of the research findings progressed, it became apparent that the awareness level of regional participants' industry specific technology use was minimal, which could be influenced by their educational background. Nevertheless details regarding levels of education were not requested. This nominal level of understanding was also illustrated when compiling the technology word lists, revealing that within the sample group there was also a relatively limited knowledge of current terminology.

When the word lists were discussed within focus groups, two of the groups were given the terms associated with technology to consider, in which they were asked to identify up to ten words that were important, from that list to specify three words considered to be key. Only one of these two groups identified proposed more than the three key choices, illustrating either a reluctance to commit or a further indication of limited knowledge. It was suspected that this was due to limited knowledge of product capability which also a factor affecting the uptake of technology. This has been key to the research findings, as by improving MSME businesses awareness and knowledge of currently available technologies the level of interest in implementation might be raised. This could also increase understanding of the realisation of what the facilities and capabilities could offer and ultimately lead to increased uptake and utilisation.

This issue is also closely connected to the research question, in the respect that the MSME businesses do not appear to stay abreast of developments in new technologies. Having undertaken a study that incorporated an investigation into the types of technologies currently available, the researcher was able to empathise with the reluctance of small businesses to do this, as if a company does attempt to identify a technology solution, there is the possibility that it may or may not be suitable. Undertaking this process is a very arduous task, time consuming, disjointed, complex, and rarely straightforward, with no guaranteed end result or outcome. Understanding that this could be a need for the sector has reaffirmed that there would be benefit in

making the process of identification less complicated and more transparent with the aim to aid both the end users and the providers.

When considering the data compiled within investigation E1 P1 it was realised that the words indicated what was known explicitly by the respondent, whereas the diagrams which are described below were purely interpretations of the respondents' implicit knowledge. The common factors that emerged from each component of the exercise were;

Word lists

- The broad scope of the words added
- There was little consistency apparent
- There was limited knowledge of technological phraseology

On first consideration of the wordlists compiled during E1 P1 there was a realisation that due to the way that the data collection had been approached in which participants from each of the three industry sectors: design, manufacture and market. Querying representatives with a diverse knowledgebase provided a selection of words that was not very structured, almost random, showing there are different ways of thinking within the same sector. This was the first stage where the realisation occurred that there was a limited knowledge of the phraseology associated with technology due to the restricted list that was generated.

Prior to conducting the analysis of the diagrams, there was the expectation that those created to illustrate the respondents' area of specialism would illustrate a higher level of understanding and ability to articulate their knowledge. Within the results the findings from the diagrams in the extraction phase were undertaken at two levels; using the systems thinking analysis (O'Connor & McDermott, 1997) to quantify the complexity of the diagrams, also the approach that considered the terminology used within the diagrams, these will be summarised individually;

Systemically analysing the diagrams:

- Tended to be a complex rather than simple task
- Involved multiple components
- Tended to result in neither linear or cyclic forms
- Found the majority illustrated linked components
- Found the majority of links were one way

- There were many interpretations of the same process
- There appeared to be few similarities between the diagrams
- There were different levels of articulation between respondents knowledge and their ability to visualise
- The majority of participants were able to illustrate links between the processes
- The diagrams did illustrate a high level of detail complexity

Forming the second element of the preparatory exercise, the diagrams created offered an insight into how participants considered their role. As can be seen by the common factors list above, the diagrams illustrated that the participants tended to be able to articulate the complexity of the processes within their sector and the industry. The differing content of the diagrams illustrates that practices between organisations vary, but also as they have been completed by individuals to illustrate their interpretation which has an effect on the content and the form. When considering the articulation of the processes into diagrams, it must be acknowledged that this was an entirely new process that was undertaken by industry practitioners who were unlikely to have encountered this before. What the initial analysis of the diagrams showed was that even though there was no prescriptive 'process diagram' illustrating standardised tasks, the participants involved were able to apply the knowledge they had of industry practice into representative diagrams.

As previously discussed, the findings obtained from analysis of the diagrams show that the understandings of the way in which sectors interact will differ from individual to individual, illustrating that interdepartmental knowledge is also likely to be limited. This result also shows that if companies are intending to invest in technology then the end user should be heavily involved in the selection process as they are more aware of the needs and requirements of the facility. However, if they are not technologically adept they would benefit from a way to gain access to user information from those using a similar system.

The results obtained from the technology providers completing a short questionnaire at an international trade fair illustrate:

Technology providers

- Offer a great deal of choice of product types and specifications from many different providers

- Ranges of products tend to be poorly promoted, often to a limited audience
- Often do not make their technology particularly accessible

Investigating and querying the technology providers offered a valuable insight into the diverse range of technology products which are available to the sector. Understanding the significant level of choice available to the market made the issue of the providers' reluctance to advertise more pertinent. The situation of diverse product choice relying on poor publicised product information shows that opportunity for identification of technologies is restricted. As this apparent restriction is down to the providers, the question must be considered if this was a conscious decision to dictate their market presence. Of all the industry sectors that were queried, the technology providers were the area that the researcher had limited prior understanding of. The findings that were obtained showed that this component of the industry is also very disparate in its geographical existence and with the products and services they provide, much like the MSME businesses considered in the main part of the study.

This next section considers the findings from the two phases of data obtained from the retailers. As the topics queried within the questionnaire and the interview were so closely connected, only one common factors list was generated, and the discussion of the emergent issues related to the both phases:

Retailers (in summary of both the questionnaire and interview)

- The technology is being utilised, to differing extent and for different purposes across the sector
- There was no consensus as to how technologies were identified
- Investment in technology is dictated by budgets

Incorporated into the study to represent users of industry specific technologies, the high street retail sector was questioned about their interaction with technology. The general consensus obtained through the questionnaire was that there was a need for technology within the clothing sector. Participants were queried in order to establish how the technologies were identified, however no preference was stated. This was relevant, as if there had been a more favoured approach, which could have been suggested as an approach for MSME businesses undertaking the same task.

Consideration of the results from data collection components within the extraction phase has identified a number of key factors; that the wordlists and diagrams

effectively gained insight into MSME terminology use, and knowledge of processes and practices; that the technology providers have the products to offer the sector, but due to their approach to sales generation tend not to advertise; and that the retailers do use the technologies devised for the sector but did not illustrate a preferred form of identification. These factors appear to put forward that in terms of practice, as suspected, within the clothing sector there is not a commonly used approach to any process. Also the issues behind, and relating to, the limited technology use within the MSME sector, are beginning to unravel.

6.2.2 Consolidation phase

Due to the nature of the focus group as mode for data collection, this phase of the discussion will illustrate in sections the significance of the findings that were obtained. The sections that were used during the implementation of the focus group sessions and as in section 6.2.1 the common factors identified at each section within the results chapter will form the basis of the discussion.

The first element of the focus group session was the round robin exercise in which standard statements were distributed as a warm up to the main session. As many of the comments that were made were particularly relevant to the research programme they have been incorporated as points for discussion;

Round robin

- It was identified that technology aided communication
- Also technology offered opportunities for international connections and to strengthen UK based niche markets
- Of all the sectors, manufacture was considered to benefit most through the use of technology
- From an industry perspective there was a sense of disappointment in terms of high street provision, too cheap, too much change, poor quality

Primarily included as a warm-up to the main focus group session, the round robin component generated insightful conversations around specific questions and statements. Of all the points that were discussed among the three focus group sessions, there was one aspect in which agreement was displayed, and that was the sector most likely to benefit from the use of technologies would be manufacture. The benefits associated with the use of pattern grading technology would be to increase

visibility of product details, aid communication and also to ensure their business practice was more akin to their larger business counterparts. These comments show that there are those within the sector that are aware of the potential benefits, however, there was no indications given that these practices were currently in place.

Word lists

- It is apparent that there is limited use of terminology relating to technology and its uses
- Terms identified for design, manufacture and market are fairly representative of current industry sector practice

The stage within the focus group sessions when the wordlists were discussed and refined in order to formulate representative keyword lists. The process undertaken to finalise the selection required each of the chosen words to be compiled in order to generate an overall consensus. The most frequently selected words for each sector were mainly as expected, with the exception of technology. As mentioned previously within the thesis, section 5.3.1.2, it was identified that knowledge of terminology associated with technology was limited, and the findings from this research component reaffirmed this.

Diagram

- Incorporation of feedback into the process was considered to be important
- Cyclic rather than linear processes appeared to be favoured
- Formulating a consensus was quite an involved process

Within the focus group sessions, the diagrams from E1 P1 also undertook a refinement process. The purpose was to allow the homogenous group members to discuss the diagrams that had been created by their peers. Choices were made for sector representation. As this was their own area of specialism, it was perceived that they would have heightened understanding of the processes. Selections were made by each group, design opting for two, manufacture and market one. The selections made by design and market groups were relatively detailed in terms of processes and indicated links. The manufacture group's approach to selection appeared to be determined by the meaning of the given process titles. No attempt was made to develop further meaning by indicating links between the processes. For the diagrams representing industry, the design group again opted for intricate connections between the processes. The market group selected two very simplistic diagrams showing three

main process components, and very straightforward connections. The manufacture group did not identify any, which could have been due to a number of reasons; that they did not consider the diagrams provided to be representative of industry process, although the transcripts did not show this was the case; it could have been due to this process being occurring near the end of the session, and as this group had been particularly involved in the session, that their momentum had diminished. There is also the factor of the restricted diagrams from which to make a selection, as the process had been undertaken on a limited scale there were only four diagrams from which to select.

Reviewing the final selection of diagrams representative of industry processes, shown in figure 5-11, the choices were compared against each other, then considered against the conceptual map devised by the researcher during the initial research phases. In terms of content, there were few similarities other than the terminology used on the diagrams, with form not remotely comparable. Whilst reflecting on the apparent differences in content and form, it became evident that the exercise had been approached systematically during the creation of the original conceptual map, whereas the participants had been required to produce a diagram intuitively, and to order. Therefore, a more formal analytical comparison between the conceptual map and those selected within the focus groups was not considered appropriate.

Whilst conducting the data analysis there were a number of comments within the discussion that considered factors not specifically relative to any the prescriptive phases of results analysis. These were the more prevalent issues;

Further issues

- Technology use has an appeal
- There is potential for opportunity through design
- The issue relating to employment of graduates

Due to the nature of focus group practice as a form of data collection, there is the expectation that topics not directly relating to the subject area will emerge. Other than conversations relative to the potential opportunities offered by technology use, and the presence of an underlying feeling that its' use does appeal to the MSME businesses within the sector. There was a comment made relating to the number of jobs available to graduates coming into the sector, in a way that infers there is a disparity between the provision and the need. This issues relates to comments made by the retail sector

representatives in which they perceived that the majority of graduates don't realise the diversity of roles available to them, but also that suggesting that there is a void in provision of garment technologists. By understanding that within the sector there are issues relating to the recruitment of graduates, it should be considered as an area that would benefit from further investigation.

Further insight into relating to attendance of the session was obtained by distributing a follow up questionnaire in the days following the focus group. The comments that were returned offered an objective view of the participants' experience:

Follow up

- The participants appear to consider there was good level of engagement
- Participants were encouraged by the similarity of views (across each design, manufacture and market group)
- That value was gained through attendance and the interaction

The follow up questionnaire was incorporated into the study in order to gain feedback relating to each of the focus group sessions. Constructive feedback was obtained from participants that suggested the experience was enjoyable, and that personally they gained through this opportunity to interact within a 'useful forum' to share good practice. Using this approach generated insightful observations from the participant point of view that will inform future approach to this type of research.

This study has generated significant amounts of discursive and therefore qualitative data within the focus group and interview sessions that were all considered and coded. Within these findings, there were elements that were not critical to the focus of the study which have not been included. However there were issues that became apparent that would warrant more detailed study and analysis, these can be seen in section 5.3.1.4.

6.2.3 Cohesion phase

This element of the study was incorporated to substantiate and gain a second opinion on the principal aspects of this study; generation of the keyword lists and views on the choices made of process maps that were representative of the industry processes. Therefore the purpose was to discuss and analyse the findings that were emerging. The interview was conducted as planned, and the findings from the consolidation

phase were reaffirmed but few further insights obtained were significant to the research findings.

It was perceived that a representative at this level would understand most issues associated with the sector. However instances will occur that can not be predicted. As this study was prescriptive in what was required from this data collection phase, the purpose was to gain informed opinion on the findings, to validate selections and discuss any emergent or relative issues. This process did identify gaps within the word lists and some comments were made in terms of the content of the diagrammatic content. The significance of each of these issues will be discussed in detail in section 6.3.

6.2.4 Development of theoretical frameworks

This section will outline the way in which the findings from the extraction and cohesion stages of the study have been considered in the identification of the theories embedded within the findings of this study. Due to the intention to corroborate the outcomes of previous research elements through the discussion, the comments obtained during the final summative interview.

As the data compiled within the study formed the basis of the grounded theory element of the research outcome, the results' findings required further refinement to be considered in order to generate the theory. Using the common factor statements that emerged from each stage of the data collection (as discussed in sections 6.2.1 and 6.2.2), they were compiled and grouped into themed conceptual categories and can be seen below in figure 6-1. This process adopted a further coding and refinement process, so that if necessary the researcher could identify at which stage in the findings an individual common factor had occurred. This coding was undertaken visually, and can be seen in figure 6-11 below, bracketed letters were used to indicate the stage that the common factor had been identified; (d) diagrams, (tp) technology providers. The use of colour was also utilised, with black text from the extraction stage, blue from consolidation and red to indicate the conceptual categories that were identified. The titles of the categories emerged as the themed groups formed, they represent;

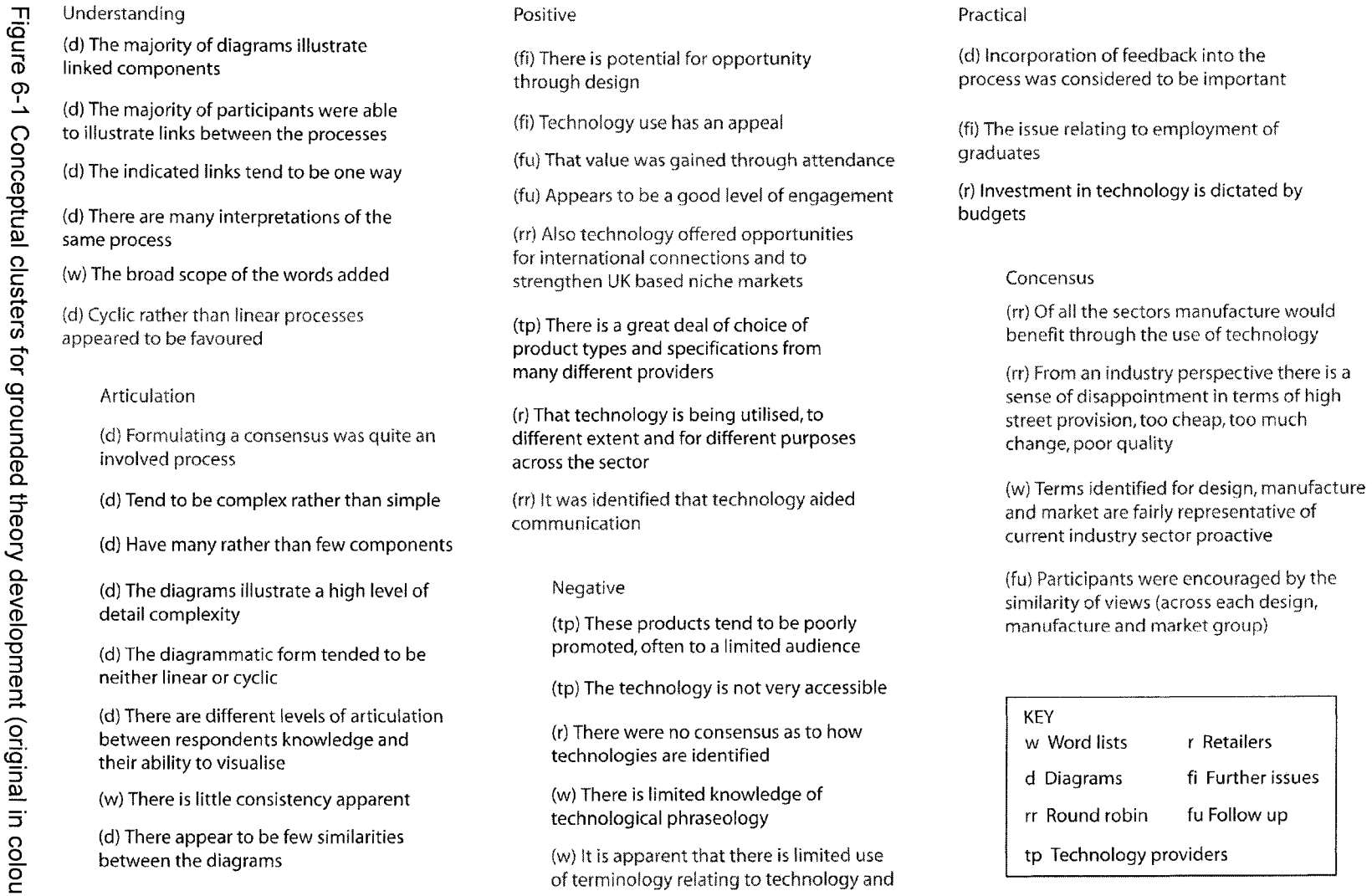

Figure 6-1 Conceptual clusters for grounded theory development (original in colour)

Understanding	Relating to the different ways that knowledge and comprehension were projected from the findings.
Articulation	Highlights the ways that participants were able to decipher and project their tacit knowledge and understanding of the processes.
Positive	Identifies the aspects that could be used to promote sector components or involvement with others.
Negative	Not to be interpreted as being 'negative', these are issues that if not addressed could be detrimental to the sector. When viewing the content of this category, there was a technological theme that related to the focus of the study.
Practical	These factors did not appear to sit well in any of the other categories. However, they were considered to have a practical implication within the sector which must also be acknowledged.
Consensus	These are factors that illustrated agreement to particular issues, each of which could offer value if pursued.

The benefits of devising these conceptual categories allow the content and focus of the themes to be acknowledged. Viewing the statements included in each category illustrates the perceived strengths and weaknesses within the sector. One example would be the level of articulation showing the strengths in the sectors ability to communicate knowledge and understanding in a visual way. There are also the negative issues, which identify the concerns relating to technologies and terminologies associated with them. These examples show that there are issues arising from terminology use that could inhibit development within the sector, the strengths illustrated within the articulation category show that if provided with the knowledge, industry practitioners would be able to understand and effectively apply the benefits.

When the titles of the themed categories were considered together, it became apparent that they were projecting meaning, and conceptual relationships (Strauss & Corbin, 1990). This meaning was interpreted through the consideration of how the categories were grouped; and was referred to as the central phenomenon phase within the grounded theory approach (Strauss & Corbin, 1990). There appeared to be relationships between the themed titles, which were interpreted as:

Affirmation	These categories identified and confirmed issues within the sector that are apparent yet generally not acknowledged.

Constructive	These categories illustrate strengths from the knowledge base within the sector that can be effectively built upon.

The use of the terms 'affirmation' and 'constructive' as the central phenomena within the study illustrates the positive feel that came through from the findings.

In grounded theory terms, the process of filtering and refining key emergent themes into the conceptual categories, followed by the identification of central phenomena to the ultimate identification of the core category (Robson, 2002) has been illustrated in figure 6-2 below. Devised by the researcher to illustrate the conceptual links that are apparent within the findings it shows how the initial conceptual categories feed into the central phenomena, which came together in the final core category. As with each of the earlier stages, a conceptual label is identified for the core category, which relates to the theme that is being proposed. As the core category illustrates the ultimate goal of the theoretical analysis the term 'heightened understanding' was devised to encompass and acknowledge all the areas investigated and the findings offered.

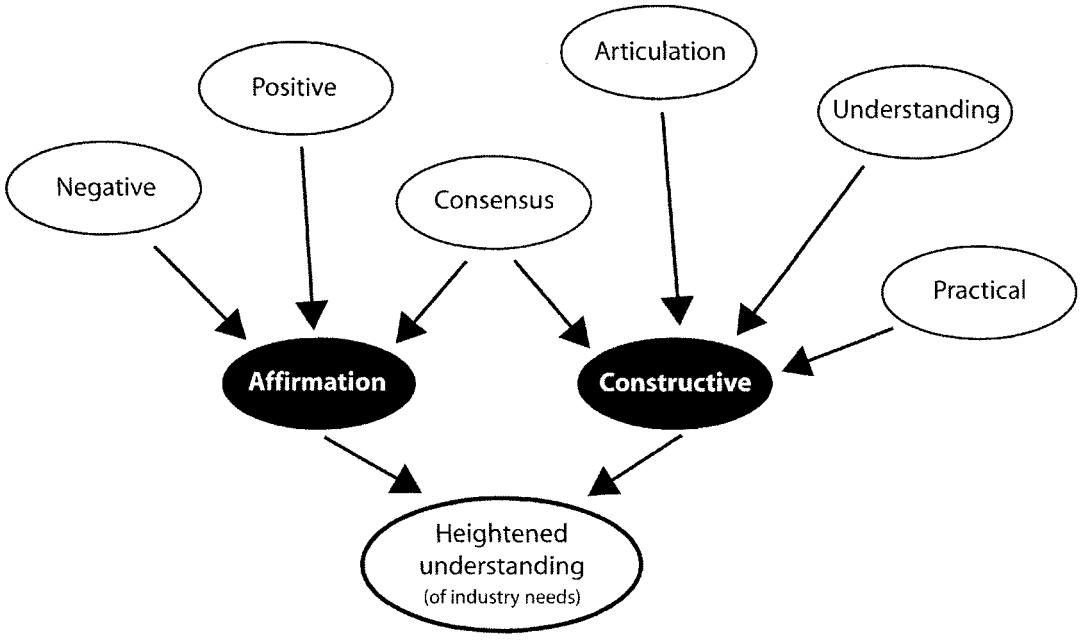

Figure 6-2 Refinement of theory

Undertaken as an approach to effectively bring together data and interpretations in order to illustrate their validity avoiding personal biases, the grounded theory approach was an effective way to tie together the research output. When embarking on the study the expectation had been that an element of negativity from within the MSME sector

would be encountered, however after analysis of the findings there was a predominance of optimism, which is reflected in the core category 'heightened understanding'.

6.3 Discussion of issues identified

Conducting this study has enabled an investigation of industry aspects that appear not to have been previously considered. As the research progressed and the findings evolved, further insight into the area of focus was possible. This section has considered the importance of the creation of the industry sector wordlists and the insight they provided, not only in terms of the words that were being used, but also the implications identified by what was not included. The findings obtained from the diagrams not only provided insights into the industry sector interrelationships, but also offered a view of the terminologies associated with that, consideration of both these aspects provided a current view of clothing sector. As technology had been utilised as the vehicle for this research programme, obtaining an increased level of understanding of current provisions illustrated the problems currently faced by MSME businesses. The last part of the section will discuss government involvement and influences on the industry.

6.3.1 Identification of key terminologies

The importance of considering the wordlists and the inconsistencies in use of terms relates to the different cultures existing within the sector. It is common place for different sectors/cultures within the industry, design, manufacture, market and academia to use the same word for a different purpose, or with a different meaning. This makes cross discipline communication inherently difficult, making it important to identify any universals (Comrie, 1981; Clegg et al., 1999) that are being used. Therefore it was considered that by understanding the how words are utilised within the sector could facilitate engagement at different levels. This could apply to internal and external industry interrelationships, for education, in order to ensure those entering the sector have a prior understanding. This could also potentially aid international communications by clarifying the terms that are used and the meanings associated with them. This section will outline the terminologies identified during the data collection and refinement process.

The idea to generate a keyword list was devised to engage respondents by requesting they add their own words to standard lists generated by the researcher for each sector. Having studied this subject area for the duration of this research programme it has been concluded that there has been no previously created list of this type relevant to the sector. Compilations of terms from glossaries that might be incorporated into textbooks, keywords listed with the abstracts of academic papers, and terminology, used by sector practitioners, appear not to have been monitored. However, due to constant industry shifts, process developments, practices altering and new technologies being introduced, staying abreast of these ongoing changes is time consuming. This fluidity in terminology changes is mirrored in the transitions occurring across the sector, therefore it is important to keep abreast of the terms and phrases that are used by all types of company in different sectors.

When considering the terms that have been added to the list, then identified as being relevant to each sector (shown below in table 6-1), many of these words can be found when looking in a clothing related book such as Jones (2002). However research has identified that it is unlikely they would ever be categorised into their relevant industry context. Inspection of the lists shows that they are relative to current practice, but if these terms are considered when looking to the future of the industry these lists would be deemed limited. Fulfilling the requirement of the wordlists, within the summative interview, additional words were suggested that reflect more the terms that should be incorporated. As can be seen below in table 6-1 and that were described in section 5.3.2 the terms added are more akin to management 'buzz' words.

Table 6-1 Wordlists identified within focus groups and summative interview

Most common terms identified following the extraction phase			
Design **9 words**	**Manufacture** **5 words**	**Market** **10 words**	**Technology** **1 word**
Computers Costings Fabrics Fit Innovation Inspiration Pattern grading Styles Target customers	Design Efficiency Fit Good communication Quality	Availability Buying behaviour Different markets - Europe, Asia Location Niche Price Profit/loss Ranges Sales Service	Communication
Terms added in summative interview			
Intellectual property	Balanced sourcing	Cost benefit analysis	Mass customisation

On later consideration of the findings it was realised that there could be a potential regional influence on the words added and subsequently identified as being key. There is the likelihood that if re-conducting this exercise in different geographical regions that the terms and phrases added would reflect the nature of the businesses within that given region. There are a number of possible factors that could influence the words added or later identified as being key, such as:

- If the company is regional, national or international
- Do they employ recent graduates
- The work background of the individual
- An individuals route into industry
- Their position within the organisation

The wordlist exercises were originally devised to generate a series of representative keyword lists of the sector. As the research programme progressed there was the realisation that by understanding the terminology used it would give credence to the additional findings. Considering the simplistic nature of the process undertaken, the value of the output far exceeded expectation. The process enabled a clearer understanding to develop of those terms which might be considered universals. Universals would be a key influence in effective communication between: design, manufacture and market.

Reflection on this research element has identified the value to be gained through the consideration of commonly used terms. This study was based on the clothing sector, but a similar approach could be utilised in any environment. Considering the value that was gained through the identification of key words and universals, it is proposed that if this study was ever repeated it would be interesting to conduct the word list element of the knowledge elicitation exercise to determine the level of comparability of meaning.

6.3.2 Understanding of interrelationships

At the inception of this study, it was considered that by gaining an understanding of the interrelationships that existed within the sector, that this approach would also identify ways in which technologies could be utilised to aid the sector. As the research and the analysis progressed it became apparent that the importance of the diagrams was more about getting practitioners to articulate their knowledge into a universally usable form. These diagrams were able to effectively capture tacit knowledge in a way to take them

forward through analysis and discussion. This approach has the potential to provide a powerful tool for companies or agencies to develop practice from an existing knowledge base.

Forming a vital element of this research programme the generation and analysis of process models offered opportunity for industry representatives to discuss the processes and roles in which they were involved. Within the group sessions, participants considered, discussed and identified the model they believed to be most representative of their sector and their interpretation of the industry as a whole, which can be seen in section 5.3.1.3. The findings do not propose that the models selected should be put forward as definitive representations, however this study could be considered as a basis for further investigation into industry perceptions of inter-sectoral relationships.

Incorporating diagrams into the study provided powerful way to illustrate complex processes, in a way that each of the participants were able to relate to. The benefits of using diagrams are that if formulated effectively removes the need for accompanying textural explanations. The consideration of the diagrams offered an insight through the inclusion or omission of links between processes that could imply there are issues with communication and management. In the instance of this study, the findings obtained shows that there was a high level of awareness of the links, and therefore the communication between each process. Used as a basis for discussion process diagrams have proven an effective form of data collection.

6.3.3 Perception of industry

Looking in general at the industry, it is apparent that a significant level of competitiveness still exists on an inter-organisational basis. The findings from this research show that it is unlikely that non-retail businesses within a region with such disparate end products will be in close geographical proximity to their main competitors. However, the insight gained through this research illustrates that links between businesses are unlikely, reducing the likelihood that businesses will benefit from developments occurring within local industry networks. Bearing this in mind, the value of the development of the cluster group principle as outlined in section 2.2.3 can be recognised. Further consideration of this observation identified potential for a community infrastructure to replace those of the past.

During the analysis phase, listening to the comments and discussions which occurred during the focus group sessions, it was identified that within this industry there appeared to be few opportunities to have discussions with colleagues within the sector. Further understanding of these findings developed into a realisation that as the dynamics of the industry shifted, with large scale manufacturing moving offshore, so did the existing community, which was built around the industry. This refers to interaction occurring between businesses that do not have existing business relations, but who may have formed non-business relationships through trade fairs or shows. There is a fundamental relevance to this observation, as without situations of this kind there is little or no opportunity for businesses to learn from good examples, experience, knowledge, problems, good practice, bad practice, costly mistakes, all key to the development of a community, or in this case an industry, and its effective engagement with technology. The realisation that this could be a key issue relating to the current industry where many businesses work separately in silos, rarely interacting or exchanging knowledge is a problem that could be addressed

There are also issues related to companies wanting to be involved with other companies, in cluster groups or similar meetings. There appears to be a mindset within the MSME business segment that there needs to be a beneficial reason for them to be involved in any schemes or meetings (Revelins, 2007). This will be in part due to the culture of independence that became apparent during the course of this study. However it was concluded from the feedback given following the focus group sessions that there could be ways to further encourage sector involvement. Vital feedback was obtained following the focus group sessions from the follow up questionnaire where respondents were asked to put forward ways of improving this type of session, a number of proposals were made; to utilise the 'breakfast seminar' approach, between 8-9am which would be less intrusive on the working day, also linking to industry or external government agencies such as the Chamber of Commerce; to hold events in different business premises each time, as that could offer element of intrigue and interest as the main impetus to attend. These suggestions would be appropriate to any future study investigating an industry sector.

The aspect of community is an area that in hindsight the researcher wished had emerged at an earlier stage, as it could have been incorporated into the discussions around the subject. Another relative issue is there could be a regional element to this lack of 'community' phenomenon, but having spoken to representatives from a Midlands based clothing related agency (Revelins, 2007) it appears that this is

representative of the sector there also. This also relates to regional networks which tend to exist through government agency intervention. They are in place, but there is no way of knowing without further investigation whether they would ever be able to recreate the levels of interaction that have previously occurred within a trade fair environment.

The regional Skillfast-UK meeting that was utilised for data collection is an event that takes place biannually. Reflecting on the organisations that were in attendance, there were only five businesses directly related to the clothing sector represented. Others attending were from training organisations and business consultants that worked with regional clothing businesses. Discussion with the event organiser revealed that the companies present were regular attendees, and that numbers at such events tended to be low. Observing the interaction between businesses involved in this study, it is apparent that there is little evidence of friendly competition occurring. Within one of the sessions, a comment was raised suggesting that businesses could learn from one another, with one focus group member stated to a fellow participant 'that there is a lot we could learn from your practice and experience'. This comment was not returned to with an offer of help, the comment was little more than ignored. It is understood that this instance was in a fairly intense environment, and that this approach was not very appropriate, however throughout the period of time undertaking the research with the regional MSME's there was no comments made inferring any of the businesses worked together.

6.3.4 Understanding industry specific technology provision and use

Studying industry specific technology provision and use was a critical aspect of this research. Approached from a provider, user and potential user point of view to gain insight into products, applications and adoption the findings formed the basis of the theoretical development. This element of the discussion will illustrate that the focus of the investigation into technology was not so much about the technological details, but more about the tendency for the technologies not to be accepted or utilised effectively. The indication is that technology is only being used to a limited extent, with no real explanation as to why. Through consideration of the industry as a whole it is apparent that the technology is available, however the lack of motivation and acceptance from potential end users, combined with the approach to sales generation by the providers has created an impasse. Understanding this bottleneck raises the question as to whether this will change if the situation is considered from a different perspective.

When undertaking the literature review to gain insight into the technologies available, it became apparent from the findings that this type of specific product information was limited. This was also the stage in the project when the realisation occurred that the choice of technologies available to the sector was vast. For IT based facilities alone there were circa 200 providers.

A clothing educational and employment background provided an existing working knowledge of the main generic technology facilities; Design & Product Development, Retail, Sourcing, Logistics & Transport, Information Technology, Manufacturing Technology. It must be noted however, that these generic terms are only an indication of the facility that is provided, as each organisation will have their own interpretation and therefore application of the process. During the study, the researcher experienced the advantage of awareness and cognisance of the functionality of these systems. This understanding was of benefit to my research planning and process. However, for those not conversant with industry technologies their need to investigate and learn about opportunities could be thwarted by poor access to specific product details, which may not to be available through secondary sources. Such information is more likely to be available directly from providers, or through any online facility they offer. There is a problem however with this approach, in order to gain more information the person searching has to know the providers name and the product type. It is proposed that without prior knowledge or support this approach would achieve only limited success.

On reflection on the current situation regarding product availability, it is apparent that there is little or no transparency to this process, with little or no guidance from which to increase awareness and understanding. The apparent hopelessness of this situation is manifested in the apparent lack of adequate promotion and customer education of the providers. Referring back to the results shown in section 5.2.2, of the seventeen organisations questioned, a 75% majority suggested their main source of sales originated through recommendation, with only three companies stating theirs were through advertising. This could imply a number of things; limited advertising in accessible trade press, that they have a low profile within the MSME business sector, or that they don't see MSME businesses as a viable market. In hindsight this was a critical discovery as this would not have been available through secondary sources.

These arguments are further reasoned with the findings from E2 and E3, as they also show that the majority of sales were secured through recommendation. In E3 insight was gained into the perspectives of industry specific technology end users through the

high street retail sector. Since making a comparison between large-scale retailers and regional MSME businesses was impractical, it was undertaken with the intention of identifying and promoting the values to be gained through technology use. Many small companies exist without the use of industry specific technologies, they undertake their product related processes in the way that they always did. As there is limited promotion of the benefits, these businesses are unlikely to want to dedicate effort to a venture that may not be forthcoming.

There is also an issue that arose that illustrated an element of conflict between front end and back end technologies used by the larger retail companies that were questioned, as outlined in section 5.2.4. Two of the companies used either a very basic or dated system for the design, planning and production side of their business, while their front end 'public face' technology, their website appeared to be state of the art. This situation did not affect the consumer in any way. The only detrimental effect would be the restrictions on levels of product detail visibility, achievable with the currently available industry specific technologies.

Identification of suitable technologies to be used by smaller businesses is not straightforward. There is a sense of opacity in terms of choice, which could further add to confusion after the initial decision has been made. Consideration of industry perception has identified that industry specific technology is more likely to be a want rather than a need. Therefore any process of identification needs to be simple and effective. One option that is available is the US based website Apparel Search (2007) offer the potential user a list of possible technologies. However, unless the individual searching the list has prior knowledge of the types of technology that are available, then they are undirected. Having investigated the site it was not found to be intuitive, and the format was quite longwinded meaning this approach could easily add more confusion and ultimately trigger disinterest.

Within the UK, government agencies are in place to encourage and develop sectors of the market economy that have been identified as requiring assistance. There was a period of time during the mid to late 1990's when the clothing sector received significant levels of support. However, in light of the change in climate with the increased levels of reliance on offshore production, and the improving status of the retail sector, this situation has changed. Formally based on the outskirts of Nottingham, the International Clothing Centre recently closed, which has subsequently removed one of the focal points of the industry redevelopment programme. This

discontinuity within the sector does not encourage businesses to interact. More-so it creates feelings of despondency within the sector.

During the time dedicated to this programme the researcher attended a number of talks not related to the clothing sector which outlined government initiatives that were in place to aid small, regional businesses.

What this study identified was that information regarding industry specific technology was available, however due to the ineffective channelling of this information the likelihood that the potential end user would have gained access was unlikely. There were also issues relating to how the information is made available and how it was portrayed: identification through trade journals is sporadic, generally there was little unbiased specific information available; obtaining details through trade fairs was likely to be in the form of promotional brochures; viewing details online is only was possible a) if the enquirer knew what they were looking for and b) whether the enquirer was aware of the relevant suppliers; the findings from the technology providers also suggested that cold calling was an approach they adopted. However, as an enquirer you have to be identifiable as a potential target customer. By understanding that these are the principal sources of product information there are a number of issues that are apparent; if a business does not subscribe to trade press, go to trade fairs, or use the internet, it will be unlikely that is details are available to potential cold callers, there is a significant proportion of businesses that would slip through the promotional net. What is required is an alternate way in which businesses are able keep abreast of technological developments that does not involve subscribing or committing to attending events.

One issue that became apparent is that the end user would have different expectations than the budget holder responsible for the investment in technology. Therefore procurement will tend to be influenced by who owns the company rather than the user of the given technology. This also related to the culture of recommendation within the sector, this research is unable to illustrate how it occurs as such specific questions were not asked. It would be interesting to further consider whether endorsements are more likely to take place between CEO's or between end users, and also when recommendations are most likely to occur.

6.3.5 Consideration of government agency involvement

Conversation with government agency representatives (Revelins, 2007) infer that within the MSME business sector that there is an inherent expectation that further government aid should be provided to reinvigorate the industry sector. This section will outline the infrastructure that is currently in place to support clothing related businesses.

In terms of government agencies or organisations formulated with a sphere of activity overseeing the clothing sector, there are a number that have been identified. Each organisation has their own remit, but often due to the SIC classification system (as outlined in section 2.2.3) resulting in the remits overlapping, which on behalf of the actual businesses can have either a positive or detrimental affect. An example of this is that Skillfast-UK was devised to retain industry skills on a national basis, whereas the Clothing Centre in Coventry has been set up as a regional operation as part of the County Council Investment and Business Team. Both of these organisations are in place to aid the sector, but in different ways.

When considering the involvement of Skillfast-UK as the government agency responsible for the clothing sector, it is apparent that a number of businesses involved in this study are involved in regional initiatives and meetings. However, as two of the focus group sessions were conducted during a regional meeting it seems that attendance of such meetings can be limited. This brings the discussion back to cluster grouping and the concept of community, and whether if such groups were arranged by a member of the business community with support and assistance from the government agencies, attending meetings may become more appealing. Reiterating the point discussed within 6.3.3 relating to holding events in business premises, as the majority of businesses have a meeting room, introducing the element of intrigue into the events by going into the premises of different companies. If managed appropriately this type of event could be conducted with a proactive strategy, a representative of the host business acts as chair, in the meeting the next meeting date, venue and agenda are arranged removing the need for additional work between meetings. Also development of incentives could be introduced for businesses to be more involved in re-establishing the sense of community within the sector. An idea which occurred to the researcher was to offer subsidies to regional bodies who nominate a business representative from each region to attend a trade fair, with the understanding that on their return they come and feedback on the development of facilities.

There is the belief that the government agencies should where possible encourage and promote the adoption of innovation. Again this could offer an opportunity to build on the findings obtained within this study. If agencies are able to build on the positives, react to the negatives and take advantage of the inherent industry strengths by utilising the sectors' ability to understand and articulate. This is referring to the conceptual categories identified when the findings were considered using the grounded theory approach, see section 6.2.4.

6.3.6 Educational considerations

Educational provision was an area that was not incorporated into the research plan and therefore will not be considered in detail, however it was an issue that arose both within the focus group sessions and when questioning the retail sector. The problem that was identified concerned the issue of educational provision and the transition of graduates into the industry. The issue was put forward in three ways: that there appears to be too few graduates employed in roles associated with garment technology; there is an apparent conflict with the excessive number of graduates observed as coming from fashion related courses; and in one respondents' organisation, the recruitment of graduates has been on hold for five or six years. In relation to this point, within recent editions of Drapers, there have been a number of letters sent to the editor discussing this issue of education, from a practitioner, student and educator points of view (Best, 2007; Burton, 2007; Todd, 2007).

Within the clothing sector there is the inevitability that there are more graduates than jobs, but that factor can be seen to enhance the competitive nature within the education sector. The variation in the provision of courses across the fashion and clothing sector range from being very specific craft based, to offering insight into specific areas of design practice. Also there are more broadly based courses available which provide opportunities for students to adapt to their required role.

The acknowledgement of the issues raised by respondents illustrates how industry practitioners perceive the academic sector provision to this evolving industry. Awareness of this apparent uneasiness identifies education provision as a matter that could potentially affect the industry structure of the future.

6.4 Arising inconsistencies in use of language

This section has been incorporated to outline the relevance of inconsistencies to this research programme. This does not refer to inconsistencies arising within the findings. Its purpose is to acknowledge use across the sector of alternate terminology and job titles associated with roles. Having had prior insight into this issue there had been an expectation that it would become apparent. However, in no way did this affect the completion of the study.

6.4.1 Inconsistency of terminologies

The inconsistency of terms used within the sector is an issue that arose at the beginning of the study. Having a prior experience of this had prepared the researcher. It is possible to identify the inconsistency of terms used within the different hierarchical levels within the clothing and fashion sector, which was one of the principle reasons for the generation of the keyword list as a research tool. Consideration of the different organisational levels that exist within the sector the terminology used can be different within a region, a company, even within a department. For those that are unaware of meanings or understandings this unfamiliarity can be quite disconcerting as not understanding can lead to questioning ability and or knowledge. There is also the issue that people do not want to admit that they do not know, or have a reluctance to ask. This did not affect the research approach as more standardised terminology was used, and participants were encouraged to ask questions if there was anything they did not understand.

The nature of the industry was considered as being very fluid, terms and phrases are constantly changing, however this research has attempted to compile a representative list of terms and acronyms that are being used at time of writing. An instance to illustrate what this section intends to achieve is the term 'balance sourcing' that was only introduced during the summative interview stage, and it was a term that was considered key by the participant in the summative interview. An instance also arose where one of the respondents who should have been aware, did not recognise the term PDM. On reflection there are many different terms given to the product data management type systems, however the assumption had been made that this would be understood.

6.4.2 Inconsistency in job titles and industry roles

This is an issue that is prevalent across the clothing sector, and therefore should be acknowledged. Relative to this research programme, inconsistencies were encountered whilst attempting to identify the 'senior garment technologists' within the retail sector organisations. Identification of the correct person was critical to the completion of the questionnaire and the subsequent interview. Contact was made firstly by phone, going through the switchboard to identify the appropriate person. It was only when the written responses, in the form of the questionnaires were returned that the variation in job titles became apparent. There were two technical managers, a fit technologist, a garment technologist and a quality assurance (QA) manager. On completion of the interviews it was apparent that the correct people had been identified, however was concluded to be likely that this level of inconsistency occurs across the entire sector, making the identification of the right person problematic.

6.5 Identification of industry needs

Having approached this research programme from a perspective that is informed by experience, the researcher has an awareness of the potential gains to be obtained through the use of technology. At the outset of the study there was a notion that there would be a simple reason, such as cost, as to why technology was used. However, having undertaken a study involving different sectors of the industry, it was apparent that cost was not the only restrictor. As an issue, cost was discussed during the focus group sessions, but the comments made were not significantly negative to merit taking further. It is believed that the existing situation of awareness regarding the availability of technologies has to be improved, as does increasing the profile of technology use, in a way that it illustrates that it is not purely to enhance communications.

The research acknowledged the process of identifying technologies used within the clothing sector is complex, and that devising a way to make this more effective could aid businesses. It has also shown that the technologies are available, but due to the nature of the industry promotion is limited. By illustrating that the providers tend not to advertise and therefore must have previously identified their target market, they have reduced their potential customer base and opportunities for end users to identify their products. What is needed is a generic facility that would increase product visibility whilst enhancing industry practice. However, the aim of this research was not to provide a solution to this problem, but to inform opportunities for solution provision.

What is required is a single facility to provide a single solution to a number of the issues identified during the course of this study. Offering a one-stop-shop to find out specific technology information, government agency initiatives and also work towards developing a virtual community to replace those of recent years. This potential solution would be available to all areas of the industry, micro to large businesses, processes from conceptual fashion design to the retail market, meaning effective mode of distribution is paramount. Also it will have to appeal to all potential users and must therefore be developed appropriately. Consideration of the industry environment from the researcher's point of view has identified a number of triggers that should be considered;

- The need for simplicity and detail within the information provided
- The importance of generating interest, which can be filtered down to other businesses
- Offer users examples of successful technology use
- Encourage involvement and interaction through the facility
- Recognise achievement and development within the sector

As mentioned previously, this is purely a conceptual idea, and therefore has not been developed further within this study.

6.6 Discussion and review of research approach

This research subject was approached with existing personal experience that in a way generated the motivation to gain more of an understanding of how elements of the sector are known to utilise technology whereas others do not. Drawing on previous industry experience as a touchstone it is hoped that further value will have been added to the endeavour.

Devising an effective process to capture knowledge was a fundamental aim of the research. This was made possible by using a combination of approaches throughout the study. This study provided a way in which to gain opinion from the sector through involvement and interaction. Within a business many tasks are undertaken that are rarely acknowledged, but this approach elicited information in a form that could be discussed further within peer groups, offering a way to focus the approach to analysis for development.

As the study comprised of different stages of data collection, a process of reflection was implemented to review findings at different stages and in different situations. This approach reoriented the way in which they are perceived. This point is best illustrated when considering the diagrams. As they were being created they all articulated the individuals' perception. However, when all sector diagrams were viewed as a group, it was possible to see the differences in participants understanding through the insights they portrayed.

6.7 Critical analysis of research

On completion of the study and analysis of the findings, there is the inevitable realisation that in hindsight there would be elements of the research that could have been approached in a more effective way. Included in this section is a brief description of each element of this bespoke research programme to explain which elements that worked well or failed to meet expectation during the application phase.

6.7.1 Implementation of each element and phase

E1 P1 the preparatory exercise – At the time of devising this stage of the research, the intention was to gain an understanding of the current industry, and not to query their technology use. With this in mind the content of the exercise, word lists and diagrammatic representations were very effective in obtaining the insight that was required. As the findings of this element were also incorporated in subsequent phases of the research programme, there was considered to be great value in the very specific knowledge that was elicited.

E1 P2 the three homogenous sector focus groups - The focus group sessions were devised to create the opportunity to get the maximum information from the regional business representatives. In review, there were elements within the session that could have been approached and utilised more effectively. For example, the incorporation of two key statements relating to the research question in the round robin exercise: how does your company stay abreast of current industry specific technologies; and does your company use any industry specific technologies.

E2 P1 technology providers – Due to the circumstance in which this phase was conducted, it was considered that the questionnaire used was appropriate to the task. The trade fair environment dictated the necessity for speed and therefore a

straightforward approach to questions. If in the position of conducting a similar exercise this model would be considered an effective starting point.

E3 P1 preparatory questionnaire for the high street retail sector – This questionnaire was relatively uncomplicated in its content, distribution and return. The format used a combination of tick and text boxes that gave the respondents the flexibility to give as much or as little detail as was necessary.

E3 P2 semi-structured interview with high street representatives – Each of the five interviews were conducted using a standard format that was personalised to the responses they provided. This approach was considered effective as it was possible to obtain more detail about specific subject areas. As each interview was conducted within the participants' work place, other than arranging a time to meet to have the interview there was little control over the duration or the location in which it was held.

Summative interview – Formulated to gain opinion and summarise the findings from all the previous stages of the data collection, this was intended to be a review as much as an interview. The preparation prior to the session involved compiling and presenting the data to be effectively discussed. Only a start time was for the interview, with no prior indication of the duration, therefore the order of discussion subjects were prioritised. If undertaking interviews in the future, more prescriptive timescales would be arranged in advance regarding the time available. The final point relates to the discussions that occurred during the interview, on transcribing the recording it became apparent that the conversation often strayed from the topic area. Again, if undertaking interviews in the future the researcher would be more aware of this in order to take more control of the conversation.

6.7.2 In hindsight...

There are a variety of further issues that became apparent during the programme that the researcher would like to acknowledge. These will be considered as a series of points:

- Considering the diagrams, and their presence throughout the research process, it became apparent that the way they were grouped together was dictated by the sector of the individual who created them. These were discussed/translated on an almost peer review basis in the focus groups.

- There was a realisation that the issue associated with the community had not emerged until after the end of the data collection phase, meaning there was no opportunity to query the topic. If this had been possible there are three questions that would be valuable to gain opinion on;

    - how do businesses interact with other businesses
    - do they rate/value clusters and networks
    - have they ever attended a trade fair, explain their attitudes towards this

- When considering the component of the session in which the diagrams were discussed, the participants involved in the exercise were able to fulfil the requirements of the exercise. However, if this exercise were to be conducted again there would be value in further refining the process in order to encourage more detailed reflection and feedback of the diagrammatic choices.
- The planning and implementation the three sector specific focus group sessions proved to be one of the more challenging aspects of the research programme. Only having experienced a number of such sessions, there was limited knowledge of the requirements of focus groups, however, through careful planning confidence in the content aided the implementation. Conducting the sessions was quite nerve-wracking, especially in the manufacture and market sessions where prior to the event there was an element of uncertainty as to the numbers attending. Also in planning the session, unless a researcher worked with the group previously, there is no way in which to predict the group dynamics.

6.8 Summary

Throughout the discussion, reflection on the original research intention has been implemented, in order to understand current industry and to identify opportunities for change through the use of technologies. The research programme was able to identify that there area a number of principal reasons behind the sector's apparent reluctance to change;

- Both internally and externally there is limited understanding of the complexities of the clothing industry structure
- Due to the diversity of business types, requirements for industry specific technologies can be very different
- There are few opportunities to gain awareness of industry developments

- Devise a way to develop the culture of recommendation at multiple levels within an organisation

This study has provided an increased understanding of technology, or lack of technology use within the MSME sector, also the roles and relationships that exist between industry sectors, which also revealed an inherently competitive culture across the sector. The research has also shown that the clothing sector predominantly exists of businesses that often work individually, in silos, rarely interacting with other organisations to discuss developments of process, or change in practice. The realisation is that this situation could restrict opportunity for development not just for individual businesses but the industry sector as a whole. Within this environment in which businesses vie for success makes the proposal of change difficult, therefore creating a solution that does not require personal interaction may prove effective.

This diagram in figure 6-3 has been devised to put forward how interaction within the sector could occur. It is provided as an extension to the conceptual idea that was presented in section 6.5. It illustrates that if a facility was put in place to supersede the current situation in which businesses gain information about available technologies through trade fairs and press. The model was formed on the basis of the research findings, and illustrates that direct or indirect communication between each of the three industry sectors could be improved. The rationale behind this is that currently MSME's, high street retailers and the technology providers exist almost as islands, where if a facility was offered to provide a 'meeting place' where they could easily and anonymously interact. This would offer industry representatives the opportunity to communicate which has the potential to increase interaction and in turn encourage development within the sector.

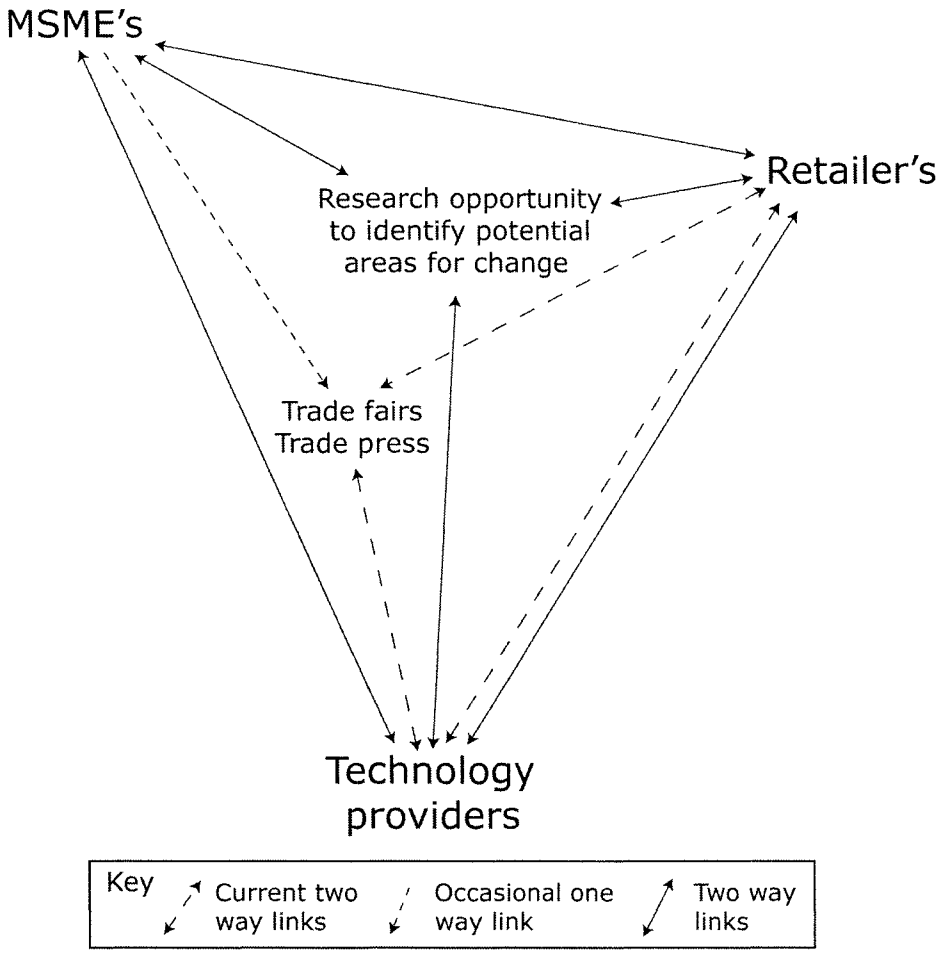

Figure 6-3 Current and proposed links needed to identify technologies

Consideration of the research findings through grounded theory illustrated that inherent industry strengths are still apparent, such as the similar thinking that was identified by all those completing the follow-up questionnaire. Using these strengths as a basis for change could ensure that the introduction of a new way to interrelate with similar businesses could prove effective. If considered plausible, it is worthwhile to consider that the feedback was obtained from homogenous sessions that were being conducted in a way that the participant input was considered valuable. Therefore offering a facility that could cater for all industry components, at all levels would maximise interaction and involvement.

Chapter 7 Conclusion

7.1 Introduction

This research focused on gaining an insight into technology use and interrelationships within the clothing industry sector to identify emerging opportunities for industry specific technology use. It created a contextualised snapshot of current industry processes and practices by considering regional MSME's, national high street retailers and international industry technology providers.

Considering influences systemically, the intention was to identify and model major influencing factors evidenced by the sector, in order that opportunities to develop greater technological awareness could be realised through increased language specific communication. The identification of factors that could encourage or inhibit potential technological development for example revealing key terminology currently used within the sector formed the basis of the main body of research.

On reflection, there were five main insights that were gleaned;

- heightened understanding of the regional MSME sectors' limited insight into technology
- identification of concerns relating to the transparency of technology identification
- there is a vulnerability present within the sector, shown through companies unwillingness to reveal their limited understanding of available technologies
- creation and successful application of a developmental approach to research
- identification of a way to maximise communication through discussion of common agendas

Recognition of the findings relative to technology use, illustrated through a combination of limited knowledge and issues with identification, that there were factors other than costs that impeded the adoption and utilisation of technologies. The third output was not a deliverable in terms of the research question, devising a hybrid methodological approach to elicit the required tacit knowledge insights proved beneficial to the research programme.

The specific research subject area is new, with associated research in this field based around the use of specific developmental technologies, or consideration of the sector from a business point of view. The focus of this research was to gain insight into different sectors and components of the often overlooked, quietly vibrant clothing sector. It revealed the inherently competitive nature of the sector which was not conducive to recommendation, nurture or development. Furthermore the intention of this research was to consider technology use from a broad perspective in order to facilitate change by identifying potential problems and solution directions and identify a means by which to share knowledge in a non-threatening way. This situation is also affected by the provision of technologies to the sector, which is dictated by the facilities made available and the extent to which they are promoted.

7.2 Summary of research approach

Forming the backbone of the research programme, the research question, aims and objectives outlined in the introduction, were devised to ensure that an original contribution to new knowledge would inform opportunity for the development of economic gain in this area.

7.2.1 Revisiting the research question

Devised from the original research focus, the research question incorporated all the elements that were considered pertinent to this subject area. For this programme of study, the process of development was complex, as this question was required to provide structure and deliverables to the research outcomes for a vast subject area with no apparent theoretical underpinnings. The research required relevant communicable knowledge to be imported from other fields (Robson, 2004) to be considered and applied in order to identify and develop substantiated theoretical concepts.

The intention of the research was to undertake a specific study based on technology use, as an element of the industry that has rarely been the subject of extensive bodies of research. Reflection on the substantive nature of this subject area and the research approach to the topic, it is worthwhile to acknowledge through a heuristic approach the difficulty involved in the definition and final creation of the research question. This issue is discussed by Robson (2002, pp 55) which describes the problems associated with this type of 'important study' were driven by a problem needed to be solved

therefore creating the situation in which the researcher had 'a problem in search of a technique, rather than the reverse'. Also mentioned by Robson (2004, pp 55) was the element of luck associated with the generation of an appropriate research problem, in this instance the luck is allied to the honing in of the subject area in order to produce a coherent research programme and the serendipitous moment when the potential of the research was realised.

The question that was presented within the introduction is shown below, for the purpose of this section the words in italics are areas of the question that imply an outcome is required, these are discussed below;

Research Question: By what means does the clothing industry *keep abreast* of technological developments, *acquire*, *apply* and *evaluate* the success of new technologies?

One of the main intentions of the research was to identify the ways in which the clothing sector is able to stay abreast of the developments within industry specific technology. Results obtained during research element two illustrated that the technologies are available, however the level of active promotion on behalf of the providers advocates that new technologies are being introduced, but only to limited markets.

The process of acquisition is less transparent. This issue had been approached in research element three when querying the high street retail sector, which had been identified as organisations most likely to utilise the industry specific technologies that formed the basis of this study. When the retailers were questioned, no prevalent indication was given to a preferred approach to acquiring technologies, and it became apparent that different organisations adopted different processes to fulfil their needs.

Identification of how technologies are applied was also based on the findings from element three which considered technology use from the retail sector point of view. The most commonly used facilities were to aid design and product development and also manufacture, these are established forms of technology that enhance the processes undertaken within this complex product dictated industry.

Identifying the way in which success was effectively evaluated proved unforthcoming. This led to the development of the theory which proposes that poor communication

within the sector resulting from the removal of trade fair events the 'community' element, has greatly affected the culture of recommendation within the industry has dissipated. This situation is further exacerbated due to there being few sources of accessible literature available which objectively reviews technology facilities. This enhances the need for businesses to rely on interrelationships between comparable organisations to promote good and identify bad facilities.

As the question was written systemically to incorporate each of the elements outlined above, it was devised to allow it to be broken down into subsections in order to cover each component of the research subject. Therefore, at no stage during the research was any participant asked the research question outright, as the intended approach was to gain a contextualised overview of the sector. By using appropriately devised approaches to the selected industry representatives, it was possible to extract relevant findings that were relative to the original question. The original question had been created principally from the point of view of the MSME businesses as the potential end users of the technologies, but in retrospect the phraseology used ensured that findings from both the retailers and technology providers offered equal insight.

As noted by Robson (2004, pp 55) 'significant research is a process, an attitude, a way of thinking', this statement very much relates to this study as it applied existing understanding with current practice, which has been considered in order to identify potential opportunities for change. The research outcomes have illustrated is that this study is timely in the respect that it has identified that there are many types of technology currently available to the sector. However, there are issues associated with access and availability. Also it has shown there are opportunities for change through the creation of a tangible outcome in the form of a process to aid the identification of technologies.

7.2.2 Attainment of aims and objectives

This section outlines each aim and how they were achieved:

Aim 1 - Gaining a contextualised insight into current clothing industry practice was a principle aim of this research programme. This was achieved by gaining representative cross sector opinion from MSME and retail businesses within the UK in order to reveal their priorities in business practice.

Technology used within the sector had been identified as a vehicle by which to consider practice, therefore opinion was gained from the retail sector as known users of industry specific technology. Understanding technology use by the larger organisations was necessary to identify and consider the types of hardware and software that could realistically be filtered down to MSME businesses.

The element of the research that focused on sector interrelationships provided a valuable insight into MSME industry practice from practitioner points of view. Undertaking the knowledge elicitation process mapping exercise across the design, manufacture and market sector provided a snapshot of the different ways in which industry representatives consider each sector, and roles within these sectors to interrelate.

Aim 2 – At the conception of this research programme, it was realised that in order to effectively elicit the information needed to make any value judgements, a fit-for-purpose research methodology was needed. Devising the appropriate modes of data collection required for each research element was necessary to obtain the desired results. Once the various datasets were compiled they were analysed independently using a combination of qualitative and quantitative techniques. The findings were further considered within each research element, then finally as combined data from the entire study.

Identification of suitable research methods was influenced both by the target sector and the environment in which the data collection was to occur. For the MSME and high street businesses where more in depth information was required, data collection occurred in two phases. Whereas, when identifying an approach suitable for a trade fair environment, the creation of a short, focused questionnaire was necessary.

As a number of approaches were utilised within the study, the elements that were considered appropriate were: questionnaire for technology providers; retail sector questionnaire; semi-structured interview for the retailers. Two elements that may have been considered differently were: focus groups; summative interview, both of which would have benefited from more structure. Evaluation of the knowledge elicitation exercise found it to be an effective means to elicit tacit knowledge in a structured, interactive and repeatable format. Insight gained from the heuristic research process was considered important to reflect on the process to gain maximum benefit from the PhD study as a learning process.

Aim 3 – An important aspect of this study was to consider multiple aspects of an industry formed of many sectors and sub-sectors. One intention was to generate theoretical frameworks to reveal issues that could affect the future development of the clothing sector, to encourage and engender non-competitive communication between practitioners with similar backgrounds. With the MSME businesses, an approach was devised where homogenous focus groups discussed the relevance of anonymous, individually created process maps provided neutral topics for conversation. This provided findings that were all encompassing, and the utilisation of grounded theory offered the tools to compile and filter down key findings within each research element. This study also acknowledged that it was based on an industry which has encountered significant changes in recent years. Therefore one purpose was to identify any issues that may affect future development within the sector. Consideration of the research findings identified lack of community as being a potential restrictor to development and the adoption of change.

7.3 Summary of research outcomes

Within this programme of research three industry components were queried to contextualise the findings, this section will outline the main conclusions obtained from each industry sector; MSME's, high street retail and technology providers.

7.3.1 The regional MSME businesses

This section will outline the key findings from E1, the regional MSME business sector. These are a follows;

The current terminology list identified: A process of collection, refinement and final frequency dictated the content of the sector specific word lists which provide concise word groups for design, manufacture, market and technology. The wordlists give an insight into the extent of understanding within each area, of these lists, three were considered to be representative, but for technology only one word was identified and that was communication, which implies that terminology relating to technology is not filtering down to be recognised and used by MSME businesses. This was particularly pertinent to the validity of the research, as it shows that within the clothing sector there is significantly restricted understanding of technology and its capabilities. One way to address this would be to increase the visibility of the products and to further illustrate the capabilities of the facilities in a way that appeals to the smaller organisation.

There appears to be no concise or effective way by which clothing industry businesses are able to identify current and developmental technologies. This therefore raises the issue of how this could be made possible. The previously inherent industry culture of recommendation becoming increasingly difficult with such disparate business types with differing structures, processes, practices and ultimately needs. There is a lack of both 'community' and 'culture', which is an element of the UK industry that was previously very strong. The study of different industry sectors, and the consideration of how technology could be utilised has identified that there is a gap between expectation and provision. This raises the issue of group or community dynamics, where expansion and differentiation leads to breakdown in effective communication.

Representative sector industry diagrams: a total of 18 diagrams were originally compiled, with seven eventually being identified as being representational of industry processes. The diagrams have shown perceptions of the order of processes and links, the level to which interaction extends, all of improve understanding of how the processes work together. Knowing how companies work and how they consider their position within the wider industry shows the level of understanding of the processes and the interrelationships.

Increased understanding of the sector: Grounded theory analysis of the qualitative findings from the discussions in which the wordlists and diagrams were refined reaffirmed two significant themes; that there are similarities in viewpoints within each homogenous sector; that there are major issues relating to understanding technologies and the capabilities they could offer. These themes show that there is an inherent strength within the sector illustrated by the similar views, but also that there is apparent weakness shown by the limited knowledge base associated with technology. By identifying these issues this research has identified an opportunity for change by increasing awareness of technological facilities, but also if approached appropriately that the inherent strengths within the sector could aid the process of transition.

7.3.2 The technology providers

Relating to the technology providers, one of the strongest statements from the research findings is the fact there were issues within the sector relating the lack of technology use that was not just down to the reluctance of the end user. What this study revealed was that there were a number of issues within the sector that affected technology adoption:

1. Too much choice: Identification of technology to aid a specific clothing sector task was further complicated by the wide choice available to end users, in 2006 there were circa 200 companies offering systems and products to the sector. This matter was made more complex as there was no way to effectively gain a more detailed understanding of product functionality and specification, yet alone identifying the companies supplying these technologies. The problem was that there was a lack of transparency within the process of identification that was needed to encourage and enable potential end users to look for industry specific technology solutions to aid their business practice.

2. The products are not promoted well: This was a factor that had not been considered at the inception of the investigation. After questioning a representative proportion of technology providers at an international trade fair event, it was discovered that few providers advertise, and the majority of sales are generated through recommendation. As the analysis of the research findings progressed, this discovery became increasingly relevant. In previous years, it may have been common for the UK sector to be influenced by recommendation, however it is now more commonplace for businesses to work independently, finding their own solutions, which when you consider that complexity relating to the choice alone can make it daunting.

3. There is no apparent culture for recommendation: This issue was referred to in the previous paragraph and is something that was considered to be an area that needs to be addressed further. As identified within previous chapters it became apparent that this was in part due to the lack of community within the sector. Shifts in industry practice from a mix of manufacture and retail to a predominantly retail orientated sector has resulted in the existing infrastructure such as the trade fairs that supported industry have vanished. At these events inter-organisational communities that had been established over many years, diminished, with no comparable environment from which they can re-emerge.

To summarise, this research has identified that even before the issue of cost, which at the start of the study had been considered to be a major restrictor to progression, that there are other factors that affect the situation. Devising ways around these prevalent issues could be of benefit to the sector. One solution would be to utilise available technology, the Internet, and create a virtual community that offers an environment conducive to interaction and development of online relationships. This may give the opportunity for companies to develop a culture of recommendation, not by giving away

their trade secrets, but by sharing user knowledge about technologies that could aid business possibilities.

7.3.3 The high street retail sector

Approached as users of industry specific technologies, the retail sector representatives offered insight into technology use. These are the principle findings for this research element;

Industry specific technology is being used: Incorporating retail sector perspectives into ensured practitioners that use industry specific technologies within their workplace would be queried. The findings showed that it is common for different products and facilities to be used at different stages of the product lifecycle, illustrating that commitment to one particular brand is not the norm. This is relevant to the study as an illustration of an exemplar of industry practice, and that MSME companies should not be railroaded into purchasing a 'complete solution' from a single provider. The practicalities of this approach relate to the fact that different packages excel in different areas, rather than to opt for an entire system from an industry sector supplier that may be more restrictive that beneficial. In order to maximise their technology capabilities use of the most appropriate package for the task is paramount, as it is not uncommon for different technologies to lack compliance with similar systems, and even between products offered by the same provider.

No preferred approach to product identification: The retailers were also queried regarding the processes involved in technology identification, to which no preferred method of approach was stated. This showed that the organisations did not appear to have a prescriptive approach to locating suitable technological facilities. This is relevant as it did not identify a process of best practice utilised by technology users, therefore promoting a 'preferred' approach to MSME businesses in the position to invest would be inappropriate. The suggestion of a preferred approach to an MSME business could show the process of technologies identification as being more attainable, which could increase the likelihood that they opt to consider technology use.

7.3.4 Broader implications

Reflection on initial discussions and decisions made relating to the three main sectors of the industry; design, manufacture and market. As the research progressed it

became clearly evidenced that in industry individual roles, across sectors and departments are known to be very fluid, this is apparent in all business types regardless of size, structure or the philosophy of the business. Roles within the business should be considered within context, rather than just as a job title.
A laypersons perspective of the clothing sector would be that it projects an outwardly successful retail sector and suspect a much diminished manufacturing presence. However, the viewpoint obtained through this research has identified a sector that exists as separate entities, all of which appear to be driven by competitiveness and a desire to remain.

What this research has revealed is that in many business environments, the passing on knowledge is often be arbitrary, which has resulted in process knowledge and skills being lost. Undertaking this study has illustrated that by using a simple, structured approach to knowledge capture provides the facilities to understand the complex systems that exist and that are needed in order to evolve. It also offers the facility through increased insight, to identify ways in which to identify and implement development strategies. The increased level of understanding of the industry from within may aid advancements in process development in the future.

7.4 Summary of developmental research approach

This research was undertaken in a field of limited previous study, using an approach devised to generate contextually relevant findings of different industry components. Reflection on the research undertaken and its endeavour to gain an academic level insight into an industry not commonly associated with academia. Therefore, an element of credence should be associated with the study as the research was conducted by a researcher with prior industry experience rather than by a business analyst or computer technologist.

Through prior experience it became apparent that a developmental approach to the data collection was required. This approach that was devised elicited specific industry knowledge, know-how and understanding. The process was engineered to embrace the complexity of the subject area in a way that adapted to the individual respondents differing opinions and levels of experience and understanding. Formed of two components, the preparatory exercise utilised wordlist generation and process mapping techniques to elicit participants' tacit knowledge relevant to sector practice. The benefits realised from the two exercise components are as follows;

The wordlists provided effective way to elicit tacit process knowledge form regional MSME businesses. Approached at two levels, the words were collected from selected individuals, compiled in order to be refined with in a focus group environment, then identification of representative terms were made through consideration of overall frequency of choice. As the terms have methodically progressed through this process of elimination, the final list offers a validated consensus of terminologies used.

The incorporation of process mapping also proved an effective approach to elicit tacit process knowledge. The process was devised in a way that the compiled diagrams would provide a universally understandable source of raw data, allowing sector representations to be grouped to undertake further consideration and analysis. Utilising the collect - compile - refine approach to make the final selections were made by users of the process, therefore reaffirming the validity of the selections.

Created as an alternative to a formal questionnaire, in a form that would be more appealing to industry representatives of one of the most creative industries, the preparatory exercise was implemented and undertaken successfully. This approach combined with the focus group discussion to provide an incisive way to elicit specific industry based knowledge.

7.5 Description of key contributions

This section describes the contributions that have been generated through completion of this programme of research. This will illustrate the extent and the context in which the contribution can be considered and applied.

The first identified contribution is the contextualised insight that has been obtained into the clothing sector. The research findings provided a current view of three elements of the clothing sector; regional MSME's, technology providers and technology users within the high street retail sector.

Gaining this contextualised insight into industry practice offered a contribution in a way that no study of this sector had taken previously. Undertaken with the intention of identifying potential areas of development for the MSME sector, the study considered areas that would influence or affect progression within the industry. The approach involved querying the retailers to illustrate the technologies that are currently being used, and also the technology providers to gain insight into the range of products

available. The findings obtained illustrated that there are opportunities for change within the MSME sector which could be enhanced by: identifying a way to articulate the technology knowledgebase held within the high street sector; increase access to industry specific technologies through providers addressing their promotional strategy.

The second contribution offered by this research was the developmental methodological approach devised to elicit sector related tacit knowledge from regional MSME's. A new form of knowledge elicitation was devised into an exercise in which respondents were required to personalise a series of word lists and draw two representative process diagrams. The approach focused on obtaining individuals' understanding of processes and practices they were aware of within their workplace and wider industry. Wordlists were utilised to gain insight into terminology use and the drawing of diagrams was encouraged to articulate workings of internal departments as well as their perceptions of the way processes within industry exists. This approach compiled an extensive word list that showed the trends in current terminology use, also it provided a series of diagrams that illustrated the processes undertaken within the main industry sectors; design, manufacture and market. Once obtained, the initial findings were reviewed and refined by industry peers in homogenous sessions to provide a considered representation of the knowledge held within the sector.

The research findings revealed that the new methodological approach was effective in the elicitation of tacit knowledge that was held by industry practitioners. In the wider research context, this developmental approach offers the facility to conduct simple, interactive data collection process which articulates tacit knowledge of processes in a repeatable format.

The third outlines the theoretical reasoning behind the issues associated with the identification of new technologies. The outcome from the technology providers sector that relates most to the research focus was the illustration of the choice of available products and services. In addition was the invaluable insight into their approach to sales which was predominantly reliant on recommendation. This provided the basis for further reflection on the implications. The combination of excessive choice with inconsistent product visibility creates a situation that does not appear to benefit either party. As in the instance of a potential end user opts to search for a technology solution, firstly they need to identify a suitable product type, and then attempt to find the most suitable provider for their needs. This situation is not conducive to sector development or good business practice, and is an issue that needs to be addressed.

The fourth contribution relates to an issue that became increasingly apparent during the study which was that lack of community within the sector could be affecting the potential for development. This is an issue that relates to a number of factors: MSME companies appear reluctant to be involved in regional groups or clusters; limited direct conversations occurring between businesses; there is little recommendation of good practice occurring, which is in part due to the removal of clothing sector trade fairs from the UK. The communication-community is reliant on each other sharing, warranting frequent interactions to appreciate the value of those interactions. However, it would seem that some interactions have been reduced because they have not been effectively facilitated and the experience has been poor. Where community's communications have broken down, it has in time affected the language of its members. Without a degree of shared language rebuilding interrelationships becomes more challenging.

Conducting this research by no means answers all the questions relating to sector interrelationships or technology use, if anything it raises more. What it has illustrated is that on a smaller scale, the industry that exists is vibrant and competitive, however there are underlying issues restricting more rapid development across the sector. In terms of technology, cost was previously considered as the fundamental inhibitor to adoption. However, this body of research has identified that the additional issues of limited knowledge of capabilities and poor promotion of the products introduce further implications to the decision making process. This research does not advocate that technology use is a necessity rather that it is an effective way for businesses to embrace development and change. What would aid this situation would be an improved way by which to identify suitable facilities.

7.6 Research limitations

Throughout the duration of the study there were only a small number of issues that could be considered limitations;

Undertaking a study using developmental methodology meant that specific guidance relating to the intended application was restricted. An approach was utilised that gleaned processes from existing methodologies, which were then adapted for order to be applied to this new approach.

One of the principle observations made during the completion of this research programme was after initial reluctance to be involved was shown by industry representatives, the process appeared to be enjoyable for those concerned. Once involvement was secured participants appeared to enjoy talking about their role. Their involvement and opinion on the sector and the industry was invaluable, and gave them the opportunity to communicate feelings, passion and interest, with some finding it difficult to stop.

As an extension to the process mapping approach, there would have been value in the generation of group models within the focus group sessions to create a definitive model per sector. This approach had originally been considered, however time constraints deemed it unfeasible.

There were limitations encountered finding appropriate literature sources relating to the clothing sector, from which to base the initial investigation. Persistence and searching outside the field of clothing ensured that a full literature and contextual review was undertaken.

7.7 Areas for further research

The clothing sector is vast, and incorporates many areas that could benefit from further study. However, as the research has identified, it is difficult area in which to study, as there is extensive scope in terms of potential topics, with little research previously conducted within the field. In terms of areas for further research, there were a number of opportunities identified during the completion of this study. These have been outlined below:

To consider the impact of industrial practices, relating to issues of: globalisation, sustainability (of which the report by Robins and Humphrey (2000) provides a valuable touchstone) and consumer perceptions, to inform good practice.

Research is required to devise an effective approach to harnessing more key knowledge relating to industry practice. Conducting this research has required gaining an understanding of alternative approaches, one that would be appropriate to implement within this industry environment would ethnography. Devising a true ethnographic methodology to further investigate the workings of the industry, would

work towards capturing the inherent tacit knowledge that this research has only touched upon.

To further investigate the existence and feasibility of 'batch customisation' within the clothing industry context, through the use of 3D digital bodyscan data. Consider the retail prospects of garments manufactured in short production runs, to specified sizes, in standard styles for an identified target market sector.

To further develop the concept of a technology identification and guidance facility. Apply the knowledge elicitation methodology to investigate wearers' relationships with their clothes, to determine how this has evolved and where it is going in the future.

To study and further define the infrastructure of the clothing industry and roles which exist within it.

An investigation formulated to gain appreciation of clothing as an industry which has helped to develop and enhance modern day manufacturing techniques and retail practices.

Investigate further the issue that arose within this study relating to the suitability of higher education provision for the more diverse roles within the clothing and fashion sector.

By conducting exercises to identify, monitor and gauge universal terminology use, there could be value in identifying how and why terminologies change: are there time frames associated between introduction and adoption; and what effects there would be to industry practice if there was little or no commonality of language.

7.8 Thesis contributions

In conclusion, it is proposed that this PhD thesis has contributed to new knowledge in four principle areas:

- A contextualised insight into the UK clothing sector incorporating opinions from regional MSME businesses, high street retailers and technology providers

- Development of a new methodological approach to effectively elicit tacit knowledge from industry practitioners
- Formulation of a theory that articulates the current clothing industry position relative to the identification of new technologies
- Identified the detrimental effects of lack of 'community' existing within the sector

Appendix - Table of Contents

Appendix 1 - Conference Papers

The following pages show the peer reviewed papers that were written and presented at international conferences whilst completing the PhD research programme.

Presented at LCF June 2005

A Review of Information Technology Application: Investigating sector interrelationships in clothing businesses to identify use of digital bodyscan data

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Dr. Kevin H. Hilton
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ABSTRACT

This paper describes the considerations involved in the development and implementation of an innovative data collection process designed to extract tacit interrelationship knowledge held within the clothing industry sector. The data compiled will identify ways in which digital bodyscan data can be used to enable and enhance products within Small to Medium sized Enterprise (SME) sector (Europa) by introducing new niche market opportunities.

The effective use of the bodyscan technology by the clothing industry will offer sizing opportunities within garment production, such as e-tailoring of bespoke garments. Access to this data will enable innovation in garment design, allowing better fitting clothing for these niche markets to be made available.

The focus of this research paper is the knowledge elicitation exercise which is the initial phase of the data collection process. It has been formulated to gain the broadest understanding of the interrelationships that exist within a regional clothing sector. Results will be obtained through completion of a two phase exercise: firstly comparable results will be obtained by the respondents personalising a list of terms appropriate to current industry practices, secondly by requesting the respondent to sketch two process diagrams to represent both their area of specialism and how they consider interrelationships to exist between areas of their industry. When making a decision as to the method of data collection, it was felt that through the inclusion of the visual element, the probability of obtaining a more in depth insight into the tacit knowledge held by the respondent would increase.

INTRODUCTION

The *'clothing industry'* as defined in this, it is an industry composed of three main sectors: design, manufacture and market. The market is the most publicly connected sector, and may be considered the driving sector.

It is clear from market reaction to consumer demand that the UK clothing industry has evolved significantly in the last three decades. The introduction of sector specific Information Technology (IT) has made a notable difference to both design and manufacture through Computer Aided Design and Manufacture (CAD/CAM), and the retail market with Electronic Data Interchange (EDI) systems that are used to monitor in-store and warehoused stock levels. Familiarity and understanding of the changes that have occurred has allowed the researcher to identify how each of the three industry sectors currently exist and work together. The investigation into this established industry's knowledge and application of new technologies is anticipated to provide a clearer understanding of cross-sector value, in the transferability and utilisation of additional new technologies, specifically including digital bodyscan data. The research conducted has had a predominant regional focus, concentrating on the clothing industry in the North East (NE) of England. The region has a notable history of development and manufacture in the clothing industry, and until recently, was a significant employer due to a large number of high capacity manufacturing units. As a result of the closures, the majority of existing NE clothing businesses now fall within the SME[1]. Consideration of these elements justifies the argument, that the regional focus taken will enable a manageable assessment of the feasible implementation of regional change. In the event that change is proven regionally, the management process may prove applicable both nationally and internationally, following further research.

This research is part of a doctoral study. The aim of the PhD is to discover if the industry considers that digital bodyscan data could be acquired and used effectively by SME clothing manufacturers in order to make better fitting clothes for different market segments, such as, clothing for the older person or ethnic market sectors.

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[1] According to a directive published by the EU 1st January 2005; **Medium-sized enterprises** have fewer than 250 employees. Their annual turnover should not exceed 40 million or their annual balance-sheet total should be less than 27 million. **Small enterprises** have between 10 and 49 employees. They should have an annual turnover not exceeding 7 million or an annual balance-sheet total not exceeding 5 million. **Micro-enterprises** are enterprises which have fewer than 10 employees.

This paper describes the development of a Doctoral study data collection process. It concentrates on a knowledge elicitation exercise[2] (McNeese, 1995) designed to extract tacit knowledge from respondents. The data collected was analysed and then discussed within a series of focus group sessions, in order that accurate, explicit guidelines could be formulated. The identification of foreseeable reasons for failure was deemed necessary. Inclusion of the visual element of the exercise was perceived to provide a way to gauge understanding of a number of crucial aspects; how mental models were shared and applied within the industry, obtaining an insight into modes of communication both internally to their sector specialism and between each of the identified sectors, linking to a level of process flexibility and proactivity towards change.

BACKGROUND

The UK clothing industry had to adapt to many technological and market changes towards the end of the 20th century. These changes were predominantly driven by high-street retailers wanting both to increase product diversity whilst reducing retail prices, resulting in a predominance of offshore sourcing of mass produced products. These changes have resulted in the closure of many well known high capacity UK clothing manufacturing units (Jones, 2002, Appelbaum, 2000) including: Bairds, Dewhirst, Courtaulds and Coats Viyella. With the closure of these units came a substantial amount of negative national media coverage. This in turn resulted in a general public misconception that the UK clothing manufacturing industry was drastically in decline. However, according to the Skillfast-UK website, throughout the UK, there are approximately 40,000 companies registered as part of the clothing and textiles sector, 99% from within the SME bracket, 80% of whom are considered to be micro organisations, with fewer than ten employees.

This change within industry has meant that the majority of companies have altered both ethos and product. It was possible for smaller businesses to utilise their inherent flexibility by making frequent style changes to generate value added products that served the smaller niche markets (Jones, 2002). Once the research data had been compiled, a full understanding of the implicit links which existed within industry identified how best to utilise the bodyscan data.

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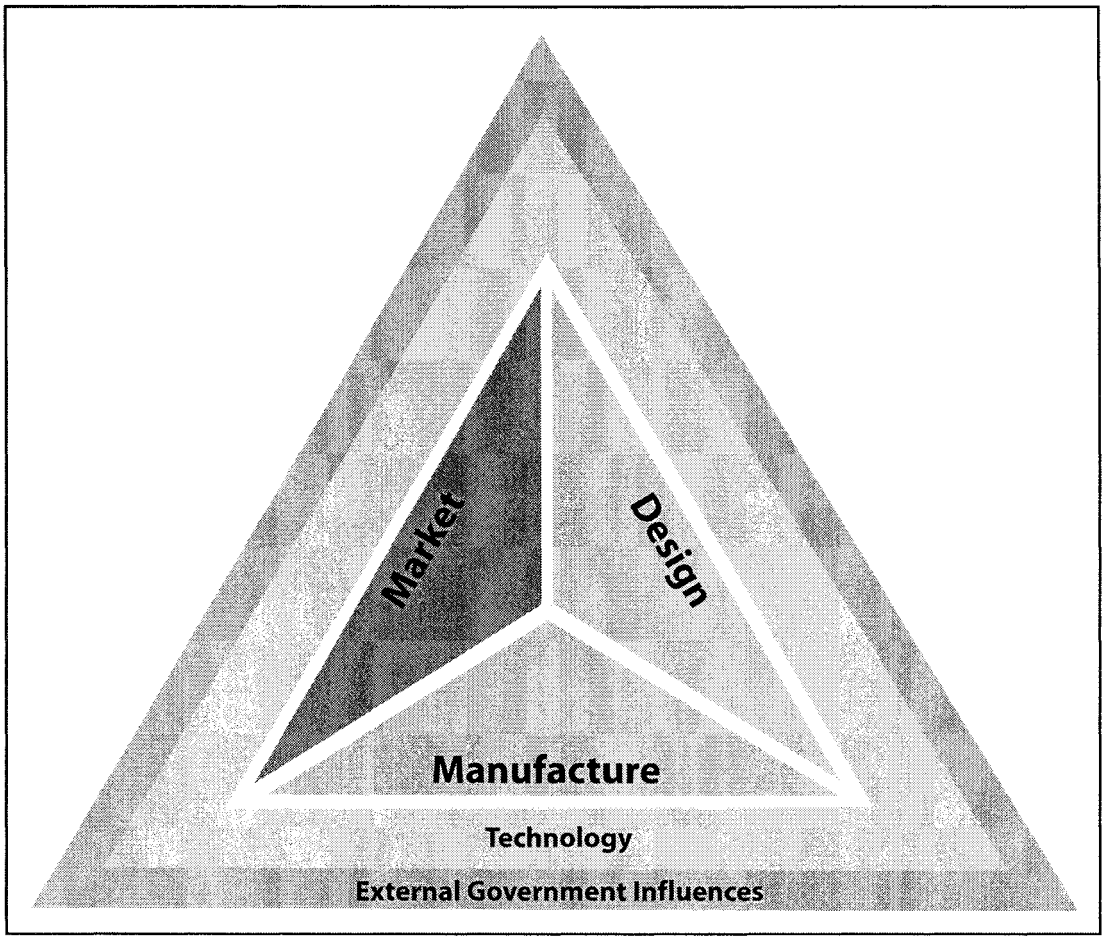
[2] The term *knowledge elicitation* is most strongly associated with the development of *expert-* or *knowledge-based systems* intended to replicate an experts behaviour in some task domain. It generally denotes the process of identifying, soliciting, and codifying the subject expert's "knowledge". (McNeese)

There appeared to be an opportunity for a new industry focus, and the development of an appropriate innovation strategy (Cooper, 2001) which could be clearly visualised. In order to implement any suggestion of fundamental process changes, a thorough understanding of the current industry and influencing factors is required. On the whole, change tends to occur only if the risk involved is perceived to be less than the potential gain. The source of the perceived risk in this instance was not only the risk associated with the adoption of the new technology, but also the finding of the best use for the data available. It was observed that companies had the opportunity to generate their own target market. The issue of determining appropriate change was considered, in terms of each sector. Figure 1 visualises the areas considered, illustrating that the three main sectors are all working towards a common goal, and that each sector is externally affected both by technological developments and government influences, in terms of policies, procedures and practices.

Figure 1: Key areas of consideration



An overview of design

Design is the creative element of the clothing industry that is able to translate fashion trends into garments suitable for retail. The industry relies on current, stylish, easy to produce garments that make a substantial profit margin in terms of cost per unit to ensure a reliable turnover. This is, in part, the responsibility of the Designer. The design element of the process can take place either in-house for the manufacturer, or externally using freelance designers, depending on the requirements of the company. There is also the consideration of who directs the design. Within a small company making their own products, it is common for designs to be selected in-house. Larger manufacturers who supply the high street retailers can work in two ways, designs could either be generated in-house to be approved by the retailer, alternatively the designs required by the retailer could be supplied to the manufacturer to be produced. Within the clothing industry the designer could be considered in many ways a catalyst, bringing together the manufacturer and the retailer to supply products to meet consumer needs.

An overview of manufacture

Due to the diversity of garments produced and the methods used, many different types of manufacturing units exist. So within this body of research, the term 'manufacture' has been used to refer to; large, small and micro manufacture, as well as Cut, Make and Trim (CMT), made to measure and bespoke processes. Regardless of the size of the organisation or the type of garment being produced, the inherent complexity of automating production processes results in labour being one of the major overhead cost factors.

An overview of market

The term 'market' has been used to encompass all established retail outlets for finished garments, including: high street shop; outlet store; factory shop; mail order and internet.

Considering clothing as an established industry, it is apparent that due to its diversity in both product and process, it has evolved in a very disjointed way. One influence is the high level of competition throughout the retail sector which has generated a 'dog eat dog' culture, with the retailer having ultimate power. Also, there is the inherent competition, which according to Jones (2002) suggests little evidence to demonstrate that the traditional adversarial links which currently exist, will be replaced by more co-operative ones.

Influence of new technology

Within the clothing industry IT has been used in the form of CAD and CAM systems to aid both design and manufacturing elements of the garment production process. According to Beazley (2003) great improvements have been made to computer systems since the early 1990's. Companies such as Gerber Technologies and Lectra are constantly pushing the boundaries of the packages they provide. For example designers are offered virtual prototyping systems, which link to automated garment development facilities that enables users to automate processes from design to manufacture.

The most recent technological advancement directly related to the clothing industry is 3D body scanning. Through the development of 3D scanning, a process has evolved that allows full size three-dimensional bodyscans to be taken. From each scan it is possible to extract over one hundred accurate body measurements, which has made feasible mass customisation (Jones, 2002, Fralix, 2001, Treleaven, 2003, Ashdown, 2003). By applying an individuals' body measurements to standard garment styles, a uniquely sized item of clothing can be generated.

During 2001 a UK National Sizing survey was commissioned by the Department of Trade and Industry (DTI) and conducted in conglomeration with a number of major high street retailers[3]. SizeUK was the first mass 3D bodyscan study of this kind in the world[4], developing the processes and software required to extract and store the immense amount of data generated by scanning 11,000 demographically representative members of the British public. Even though the study had been part funded by the DTI, the remainder of the money was contributed by the retailers with the agreement that the resultant data would be 'owned' by them. The data is currently managed by Bodymetrics[5]. Access to the data is only possible at a substantial cost and is therefore restrictive in its potential to SME businesses.

Influence from external bodies

Overall, it is estimated that around 394,000 people are currently employed within the clothing industry, contributing in excess of £11 billion to the economy each year (Skillfast-UK, 2005). In order to ensure support of the clothing industry, a dedicated Sector Skills Council, Skillfast-UK[6] was established in April 2002. This was created not only to encourage and enhance industry skills, but also to develop the industry as

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[3] Including Arcadia, BHS, Debenhams, House of Fraser, John Lewis Partnership, Monsoon, Oasis, Speedo and Tesco

[4] Subsequent studies have been completed in USA, China, Mexico, Germany, Italy and France, also studies in South Africa, South Korea, Brazil, Sweden, Ireland, Singapore and Hong Kong either being planned or are underway.

[5] Bodymetrics is the company that currently controls the SizeUK dataset http://www.bodymetrics.com/

[6] skillfast-uk is the sector skills council for the apparel, footwear and textiles industry http://www.skillfast-uk.org/

a whole. One of the main Skillfast-UK objectives is working towards the demand driven encouragement of development and retention of the specialist sector based skills needed to ensure long-term survival of the industry.
Additional external government related influences include the DTI, who in 2001 produced three extensive clothing related reports identifying the effects of e-commerce on the industry. Within the region, One North East, the Regional Development Agency, holds the overall responsibility for economic regeneration. The Northern Way growth strategy scheme was also launched in 2004 intended to reduce the gross domestic product output divide, that exists between the North and the other English regions.

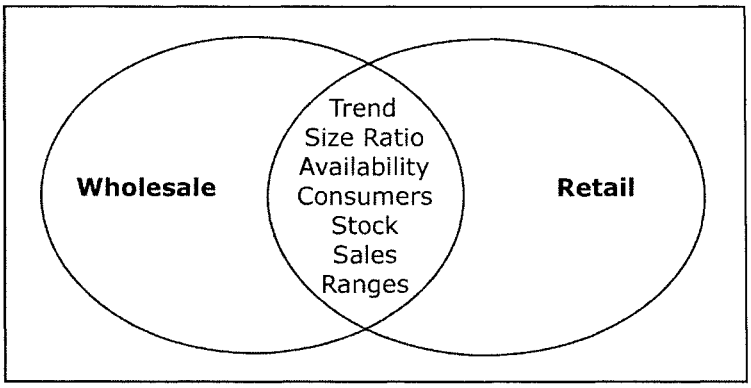
METHODOLOGY

Data collection within an industry environment is known to be difficult (Park, 2004). During the development of the research process, consideration into existing methods revealed there was no formal data collection method that could 'tease-out' the required opinions regarding sector interrelationships. The aim is develop a new way with which to access the tacit knowledge held within the clothing industry.
The approach taken is an adaptation of the concept mapping form of opinion gathering. Adapted from educational research methodologies (Novak, 1984) this process will allow the respondents individual perceptions to be identified in order that by compiling sector opinions and trends. Collection of data in this way was a progression from more established formal interviewing and desk-based research that generates quantitative results. Gaining opinions through the tacit knowledge will compile data that can be analysed qualitatively so that informed conclusions can be made.
The research conducted within this PhD programme will investigate not only the perceived understanding to be gained about the industry but also the process involved in obtaining the information. There is an inherent element of risk associated with the assumption that this method will gain the desired results. It is expected that the results obtained will illustrate the perceived value of the tool.
In order to obtain the desired data, a focused approach was required. The data collection process has been devised to extract tacit knowledge in an innovative way. An exercise has been developed that individualises the concept mapping process (Nosek, 1997, McNeese, 1995, Hughes, 2001, Kinchin, 2000), by requesting a mental model or map be generated by individual respondents. Examples of responses obtained during the pilot stage of the exercise development are shown in

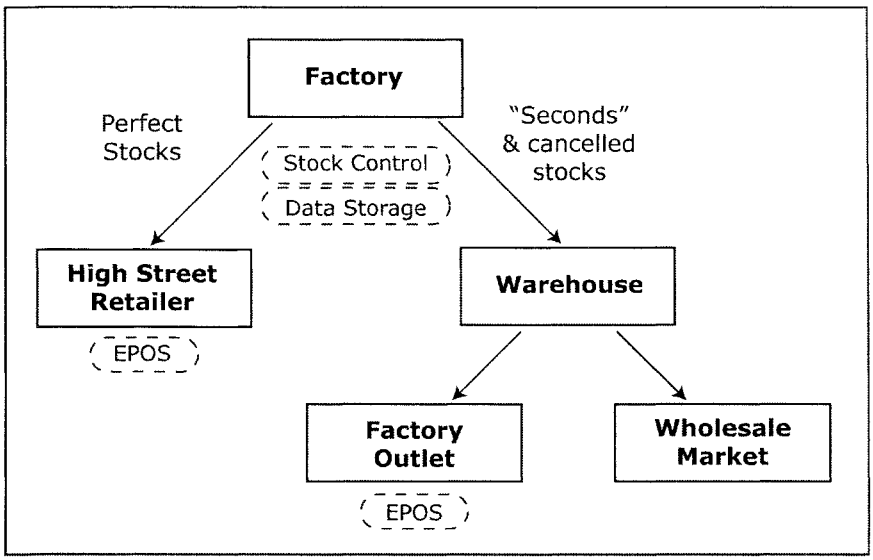
Figure 2. Extraction of personal perceptions in this way will make it possible to identify emergent trends that appear when individual responses are compared in appearance. This approach was required due to the diverse nature of the clothing industry in the NE.

Figure 2: Examples of diagrams obtained at the pilot stage

Interpretation of sector specific area of specialism (Market)



Interpretation of sector interrelationship (Market)



To ensure the perceptions obtained were balanced, a minimum of four organisations per sector were identified from a list of regional clothing related businesses.
The aim of the research was to discover that in the event of that the industry acquiring access to the digital bodyscan data, whether it could it be used effectively by SME clothing manufacturers to make better fitting clothes for different market segments. The perceived goals of this study were:

1. To investigate how mental models of new technology were shared and applied within the industry;
2. To gain an insight into modes of communication within sector specialism areas, and between each of the industry sectors; and
3. To consider if current levels of process flexibility related to proactivity towards change.

Therefore the main research question can be summarised as follows:

Where are barriers anticipated to exist, that may prevent SME clothing manufacturers using bodyscan data technology effectively?

Sample group

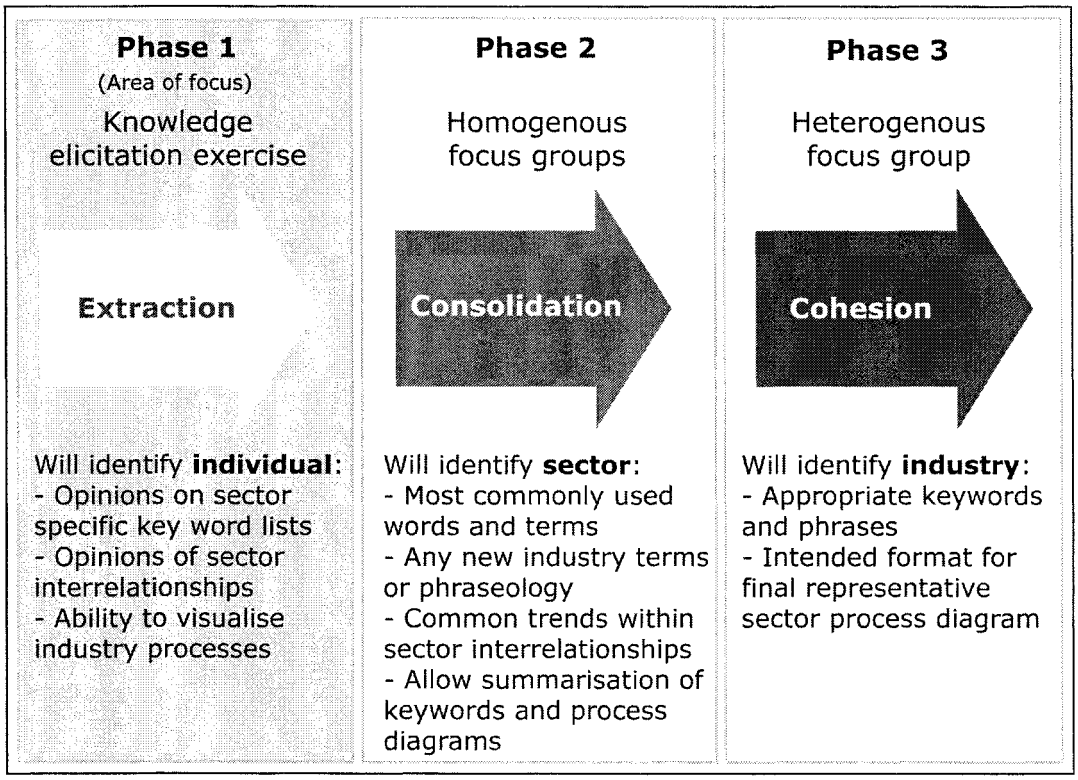
In order to achieve an accurate understanding of the existence of the current regional clothing industry, it was necessary to identify appropriate sample groups for the data collection phase. During the early stages of the research three main industry sectors were identified; design, manufacture and market, which required their interrelationships to be determined. Between the garment creation sectors there exists a complex series of interrelationships, meaning that although there is the common goal of creating garments, this may happen in different ways, for example; Cut, Make and Trim, large scale mass production, low capacity SME manufacture. In order to gain representative opinions, companies across the three industry sectors were selected, three per sector, from a region wide list obtained through Skillfast-UK NE. The companies were selected primarily due to their regional status, either as a prestigious brand or a company well known in the region. Contact details were confirmed with a pre-distribution phone call prior to electronic distribution of the exercise. Therefore, in the situation where a contact was not known, a conversation with Human Resources or a Senior Manager identified the appropriate person to contact.

DATA COLLECTION

The data collection phase of the PhD research programme is based on a combination of word analysis, exploratory visualisation, and knowledge elicitation, followed by focus group sessions to discuss and summarise the findings. A knowledge elicitation exercise was developed as a tool to obtain the empirical data required for this research, specifically to obtain respondents individual perceptions

and understanding of the clothing industry. The exercise required personalisation of a series of sector specific word lists followed by the generation of two sketches to illustrate understanding of their industry interrelationships. The visual element of the exercise was considered an appropriate tool to obtain perceptions of considered industry links. Formal focus group sessions followed, initially with three homogenous sector sessions the results of which were summarised during a final heterogeneous industry session. A visual description of the data collection process has been created, see Figure 3.

Figure 3: Planned data collection process



Phase 1: Knowledge elicitation exercise – Extraction

When developing the elicitation exercise, it was considered that within a diverse, yet specialised industrial environment an alternative approach would be required to effectively access and extract the type of tacit knowledge that exists. This was considered to be possible by using a combination of the prescribed lists to be personalised and the request to sketch not only how the respondent perceives their specialist area within the industry, but also the wider context of the inter-sector relationships. This approach was proposed to enable the participants to reveal the

process within the process, by gathering in-depth perceptions on each sector, as well as their overall perception of the industry.

Phase 2: Homogenous focus group sessions – Consolidation

The second phase of the data collection summarised the data compiled in Phase 1. This formulated mediation points used within the three sector specific homogenous focus group sessions. This ensured that sector specific consensus was obtained to formulate accurate keyword lists, and identify and discuss any new terms or phraseology used. The importance of word and phrase analysis is that it allows analysis of both the processes and merits visualised by the respondents. The focus group also gave the opportunity to discuss the emergence of any common trends, in terms of content and format within the sketches of sector interrelationships. Any predominant visual trends that emerge from this methodology could influence the format of sector guidelines, as visual contextualisation will aid understanding.

Phase 3: Final heterogeneous focus group – Cohesion

This third phase was devised to consolidate the findings from Phases 1 and 2. It is anticipated that this group would represent all the aspects of the clothing industry being considered, Skillfast-UK, One North East, Bodymetrics and representatives from the academic community. Discussions enabled an accurate and representative keyword list and an appropriate format to be finalised and used for the sector guidelines, where consideration is enabled for the 'process within a process'.

DISCUSSION

The use of digital bodyscan data within the current clothing industry appears to be very limited. Research highlighted that the cost was significant enough to deter the majority of SME businesses. Access to the bodyscan data for interested parties has been possible since early 2004. The uptake from the SME sector has been minimal, so it was apparent that an alternative means of access would have to be considered. The clothing industry has adapted to many internal changes due to external influences during the past three decades, and the intent of this research method was to therefore gain a full understanding of current industry interrelationships.

It is proposed that bringing together industry representatives with regional and sector related agencies will reveal possible routes forward. There is a need to ensure the

industry can see the potential gains to be made, whilst servicing the consumer needs.

Once the research findings are published for the clothing industry, it is anticipated that this process may be utilised by design companies within the wider context, where human based products are being developed.

CONCLUSION

There is currently a database containing the 3D digital bodyscan data of 11,000 members of the British public. It is accessed in full only by the retailers who funded the study, a handful of external businesses. Partial access is afforded to the University institutions involved during the data collection phase.

The research method employed has been developed in order to access and utilise the high levels of transferable tacit knowledge held across the industry sectors. According to Jones (2002) research and development within the clothing sector is significantly under represented, especially in terms of applications of the technology that is available. Therefore the researcher feels that broader consideration could identify further opportunities or uses of the bodyscan data. No evidence was found of the data being used in a creative way outside of the clothing field. It is proposed that if the data is used within other academic fields more creative opportunities could be identified.

This developmental form of data collection has been tested, evaluated and implemented, and is suggested as a new process.

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Presented in Copenhagen September 2005

Bodyscan data usage and the clothing design process

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ABSTRACT

This paper concentrates on the second and third phases of a developmental data collection process which was devised to enable focus group interviews to extract tacit interrelationship knowledge from businesses across a regional clothing industry sector. It is intended that the findings obtained will identify the extent to which new technologies are being utilised within the Small to Medium sized Enterprise (SME) sector (Europa, 2005). Digital bodyscan data technology is being used as a focus for the research as it is a relatively new form of technology which potentially offers new niche market opportunities to the SME sector. The investigation into this established industry's knowledge and application of new technologies is anticipated to provide a clearer understanding of cross-sector value, in the transferability and utilisation of additional new technologies.

For the purpose of this research the term '*clothing industry*' is used to describe an industry that is considered to have three main sectors: design, manufacture and market. Each sector is vital to the other in terms of the inter-sectoral stakeholder relationships which exist, the market could be considered the driving sector, design responsible for creation of styled garments and manufacturers providing necessary production facilities, all working towards meeting consumer needs.

The focus of this research paper is to outline how basic focus group concepts can be embraced and developed to allow findings from a series of preparatory knowledge elicitation exercises to be discussed, consolidated and refined. Phase two of the research involves conducting three homogenous industry sector focus groups (design, manufacture and market) in which the elicited knowledge gained from phase one will be distilled. Phase three is a final heterogeneous focus group session conducted to cohesively conclude the findings obtained from the entire data collection processes. This method of investigation has enabled a broader understanding to be gained of the way a regional clothing industry may develop.

INTRODUCTION

The image below is of a high street, it could be considered to represent any high street in a major town or city across Europe and parts of the rest of the world. This image has been included in order to illustrate the diversity of people entering this environment with the intention of purchasing clothing. Consumers should be recognised as individuals of different shapes and sizes, challenged by having to purchase the standard sized garments available through the mainstream retail outlets. Research being carried out in the UK and the USA has suggested that consumers are increasingly dissatisfied with garments available on the high street (Otieno et al., 2005, Simmons and Istook, 2003). This research programme is investigating whether, through the adoption and utilisation of new technologies with a focus on digital bodyscan data, the provision of non-standard sized garments could be embraced by the SME manufacturing sector.

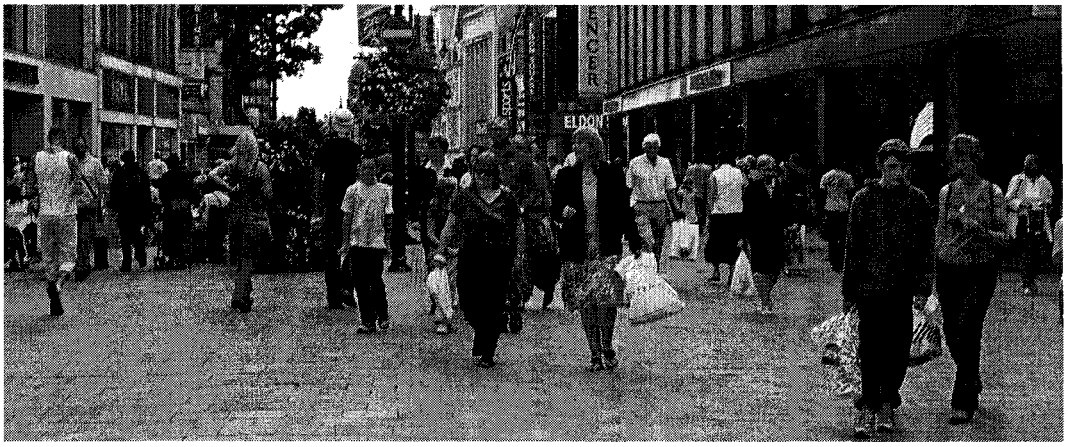

Figure 1: High Street retail environment

The research conducted has a predominant regional focus and will concentrate on the clothing industry in the North East (NE) of England. The region has a notable history of development and manufacture in the clothing industry, and until recently, was a significant employer through a large number of high capacity manufacturing units. As a result of the closures, the majority of existing NE clothing businesses now fall within the SME[7] sector. In relation to this, Jones (2002) identified that research focusing on development across the clothing sector is very limited. Consideration of

[7] According to a directive published by the EU 1st January 2005; **Medium-sized enterprises** have fewer than 250 employees. Their annual turnover should not exceed 40 million or their annual balance-sheet total should be less than 27 million. **Small enterprises** have between 10 and 49 employees. They should have an annual turnover not exceeding 7 million or an annual balance-sheet total not exceeding 5 million. **Micro-enterprises** are enterprises which have fewer than 10 employees.

these aspects supports the decision to conduct the investigation with a regional focus, enabling effective assessment of feasible change. If it can be proven that change is feasible on a regional scale, further research may prove the process applicable both nationally and internationally.

This research is part of a Doctoral study, where the aim of the PhD is to investigate and understand the level of adoption of new technology within the clothing industry using the area of 3D body scanning as a vehicle for the research. This paper will describe the considerations made during the development of the focus group. The intention of conducting focus group sessions is to discuss the findings gained previously through the distribution of an industry specific knowledge elicitation exercise[8] (McNeese *et al.*, 1995).

CONTEXT

Since the end of the 20th century, the clothing industry has had to adapt to many technological and market changes resulting in companies having to identify, re-think strategies, develop and innovate new markets. The occurrence of change can influence the momentum and direction of the industry in terms of its ability to react effectively. This in turn affects the industries ability to be proactive in its identification, acquisition and development of new ventures. It can be the case that industry stakeholders fail to identify potential opportunities, which in part is due to differences in experience and perceptions of value in change.

Innovation within an established industry often requires clear vision to convince and engage the perception that change would add value. This vision of value needs to be shared among the stakeholders to ensure successful development. Additional factors influencing change are the cost and inherent risk, which links strongly to the development of the clothing industry through the use of new technologies. Offering a 'systems view' will allow stakeholders to visualise opportunities to acquire and develop. In terms of financial investment, risk is better managed through informed decision-making. It is proposed that university based research with a specific industrial focus is the most appropriate form of enquiry. External mediation of focus groups enables an impartial account of industry perceptions to be formed, in a way which could otherwise prove challenging as an in-house investigation. The focus

[8] The term *knowledge elicitation* is most strongly associated with the development of *expert-* or *knowledge-based systems* intended to replicate an experts behaviour in some task domain. It generally denotes the process of identifying, soliciting, and codifying the subject expert's "knowledge". (McNeese, 1995)

group environment enables stakeholders to be brought together who might otherwise only have indirect contact.

The diagram below, figure 2, was created to visually demonstrate how the design, manufacture and market stakeholders within the clothing industry exist together. This diagram also illustrates that technology as a facility, and external government, as industry overseers, each encompass the stakeholders, both of which can have considerable influence on each sector.

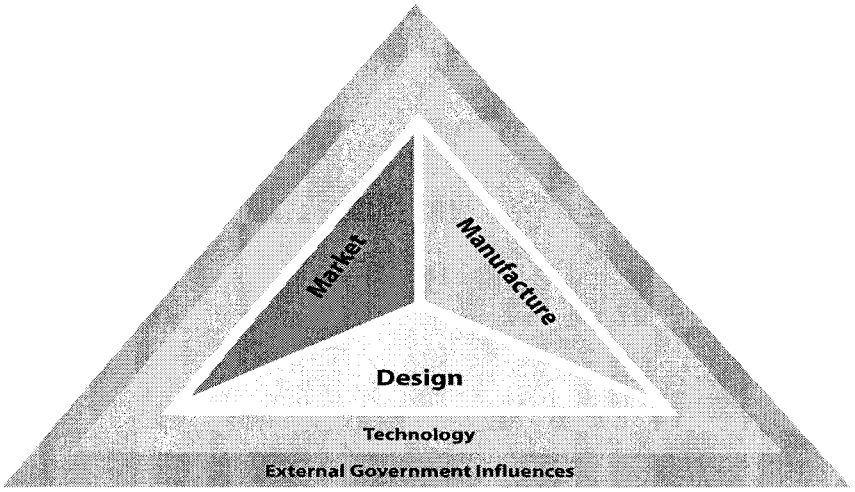

Figure 2: Industry Structure – research focus

METHODOLOGY

Data collection within an industry environment is known to be difficult (Park, 2004). The research process used within the PhD programme was developed as a new way to access the tacit knowledge held within the clothing industry. Initial findings obtained through the implementation of a cross sector knowledge elicitation exercise (McNeese *et al.*, 1995) gained insight into representative industry practice and understanding. Word list were created to enable currently used industry specific words and terms to be identified and compiled. In addition the generation of individual respondent mind maps or models offered an accurate snap-shot of the way individuals within the industry perceive interrelationships between the three industry sectors to exist.

Since embarking on this data collection process, the overall focus of the research programme has evolved. In addition to obtaining current views of the industry from regional SME businesses it was considered important to gain an insight into the way

in which the SizeUK[9] data has been utilised. This will be achieved by approaching a representative selection of the conglomeration of 17 UK high street retailers and conducting case study interviews. The interviews will be conducted prior to running the focus group sessions in order that findings relating to current usage of the data can be incorporated appropriately.

Results obtained from the completion of the elicitation exercises are to be used as the basis for the focus group discussion subjects. The intention is to use the add and amend word lists and the mental models as two sections within the focus group sessions, enabling each element to be considered independently. Both prescribed lists and added words will be considered in order that a representative industry wide keyword list can be generated. Within the specialist sectors, completed process diagrams will be compiled then considered by industry-sector in order that a process consensus can be reached for each. Also each group will generate a diagram to represent their sectors' interpretation of the clothing manufacturing process.

The diagram shown in figure 3 illustrates how conducting each of the research phases generates knowledge that has to be considered, processed and prepared prior to the next phase of the data collection. This mode of data collection will ensure the reliability and validity of the findings.

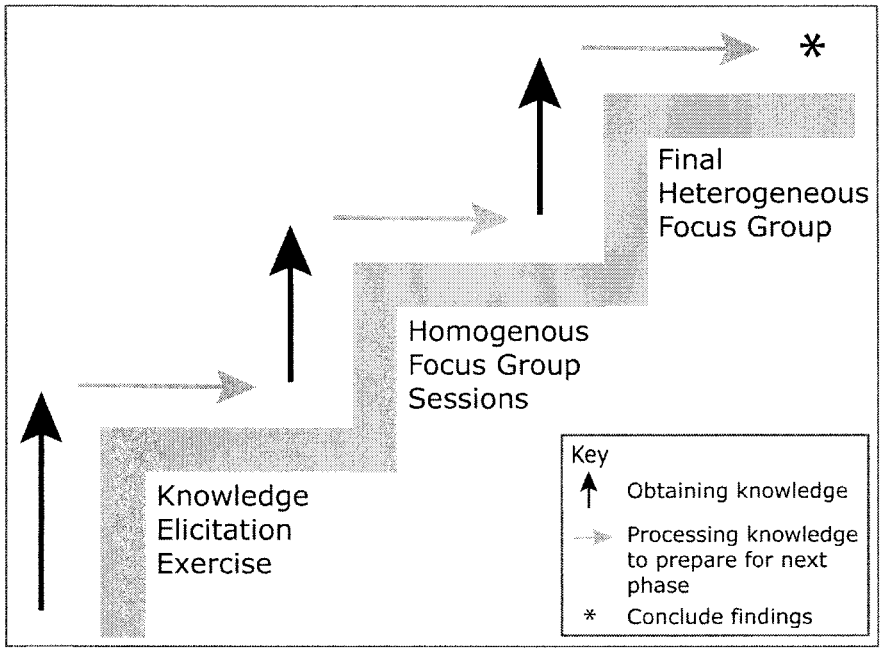

Figure 3: The incremental process of knowledge development

[9] SizeUK is the resultant dataset from the UK National Sizing Survey, it is currently controlled by Bodymetrics http://www.bodymetrics.com/

Sample Group

In order to achieve an accurate understanding of the existence of the current NE regional clothing industry it was necessary to identify appropriate sample groups to be used for phases 1 and 2 of the data collection process. Companies across the three industry sectors were selected in order to gain representative perceptions by creating a sense of 'project community' (Hilton, 2005). Five organisations per sector were identified from a region wide list obtained through Skillfast-UK[10] NE. These companies were selected primarily due to their regional status, and the respect for their brand in the marketplace.

In order to ensure continuity of the research findings, the data obtained during the initial exercises was considered by the industry sectors. The sector specific focus groups for phase 2 were made up of respondents who had completed the initial elicitation exercises, this approach would enable appropriate analysis of the findings within the group sessions.

DATA COLLECTION

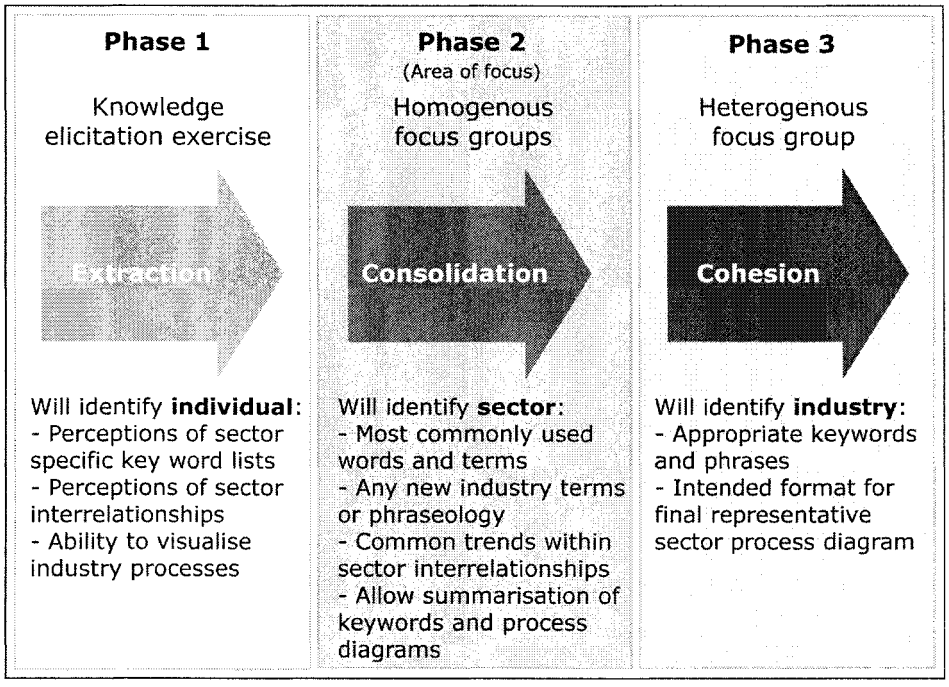

Figure 3: Data Collection Process

The data acquired during this three phase data collection process is outlined in the diagram shown in figure 3. It illustrates the three phases of the data collection

[10] Skillfast-UK is the sector skills council for the apparel, footwear and textiles industry http://www.skillfast-uk.org/

process. Information is obtained from the respondent, discussed and consolidated within three homogenous sector specific focus groups. This data then informs the findings pulled together by a single heterogeneous industry wide group, leading to tentative conclusions being drawn to inform the following stages of the research.

Phase 1: Knowledge elicitation exercise - Extraction

The elicitation exercises were developed to obtain representative perspectives from individuals across the regional clothing sector. The content of the exercise was devised in order to access the tacit knowledge held by each respondent. This phase involved two key objectives, to gain an insight into terminology currently used within the industry and also to obtain visual representations of how the industry perceived inter-sectoral links to exist. Each respondent was requested to complete the entire exercise, which had been created in a way which would probe knowledge specific to their sector specialism, as well as their knowledge of the other two sectors and the industry as a whole.

The adopted approach obtained an insight into current industry terminology by using a series of standardised wordlists. A specific word list was generated for each sector, with an additional list for technology. Each respondent was requested to consider the list, adding words they felt should have been included, this process was repeated for their non-specialist sectors. The results obtained were analysed by sector, initially in terms of frequency of occurrence in preparation for discussion within the focus group sessions.

Inclusion of the visual element of the exercise was perceived to provide a means by which to gauge understanding of a number of crucial aspects, most importantly how mental models were used, shared and applied within the industry. The approach taken is an adaptation of the concept mapping form of opinion gathering, adapted from educational research methodologies (Novak, 1984). This mode of data gathering will gain an insight into communication both internally to their sector specialism and between each of the identified sectors. Identification of these links could potentially highlight the level of process connectivity, which in turn may identify the industries aptitude for change. Examples of diagrams obtained from each industry sector can be seen in figure 5. These illustrate the different perceptions of sector specific and industry wide processes. There does not appear to be any commonality in understanding of interrelationships at this stage, prior to the focus groups. It was also noted at this point the difficulty experienced by respondents in visualising process connectivity. The provision of visuals depicting both sector

specific and industry wide processes during focus group sessions is intended to enable participants to more effectively visualise the general processes.

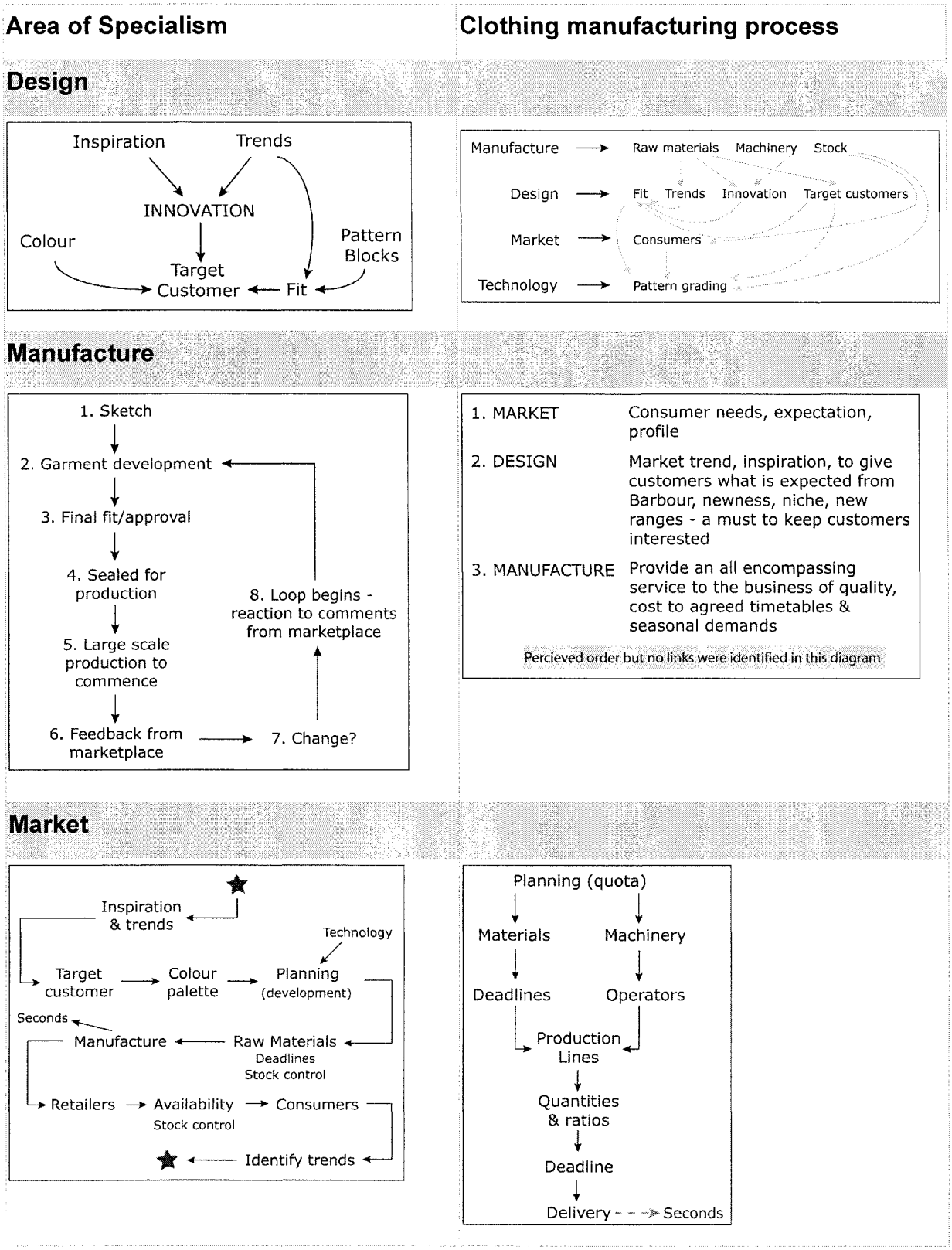

Figure 5: Examples of mind map diagrams obtained in elicitation exercises

Phase 2: Homogenous focus group sessions – Consolidation

The aim of the focus group sessions is to further elicit participants' feelings, attitudes and perceptions (Puchta and Potter, 2004) about the clothing industry. Devised as a continuation from the elicitation exercises they will be used to consolidate the perspectives of representative individuals from across the regional clothing sector. Each session within phase 2 is to be conducted with sector specific homogenous groups, in order that the common backgrounds and experiences of the group members will facilitate communication (Robson, 2002).

The design industry focused approach developed by Langford and McDonagh (2003) has been used as an influence for the format and content of the three sessions. It was considered appropriate to use each of the group sessions as an extension to the knowledge elicitation exercises, in order that ensure any patterns or trends identified were consistent.

The intention of the focus group sessions is to create an interactive environment to stimulate ideas within the discussions. Inspired by the collage, cognitive mapping and Velcro-modelling processes outlined in Langford and McDonagh (2003), the planned dialogue will be tailored to expand on the findings obtained during the elicitation exercises.

The combination of word lists will enable the development of a comprehensive list of sector specific terminology. The intention is to have each of the words on magnetic strips that can be used on a metallic board, so each word can be easily moved or discarded as required. The final compiled lists will be discussed and agreed.

The completed process diagrams (see figure 3.), will be compiled by area of specialism in order to formulate a diagram that represents a sector consensus within each group. Following this the clothing manufacturing process diagrams will be considered together in order to generate a representative model. This process of group analysis will identify the most prominent aspects as well as the perceived links and relationships between them.

Phase 3: Final heterogeneous focus group session - Cohesion

The final focus group session will be conducted using the cross sector findings obtained during phase 2 as the basis for the discussions. This session intends to utilise the heterogeneous group dynamics in order to amalgamate the findings gathered on a sector specific basis, as the members of this group will represent each industry sector in addition to academic, government agency and indirectly related industry. By having representation from different backgrounds, the intention is to consider the industry in a different light (Robson, 2002), discussion will formulate an

accurate and representative keyword list and an appropriate format to be finalised for the process diagrams.

DISCUSSION

The intention of the research is to use the focus group approach to generate a representative insight into the communication processes which exist between the NE clothing industry sectors. It is expected that the findings from the focus group sessions will reveal that there is a desire to change and innovate within the clothing industry, but that there may be a reluctance to invest significant amounts of money into new technologies. However, grants and other financial aid are seen as a preferred option.

Effective moderation during the sessions, combined with efficient analysis of findings will ensure the focus groups evolve as more information is gleaned. There is the expectation that the use of a creativity-conducive environment should result in further values to the main research intent emerging through openness of response.

The results generated from this element of data collection will be combined with the findings obtained from retail sector case study interviews to be utilised during the development of a series of comparative business plan models. These models will be used to illustrate potential ways in which new technologies, such as bodyscan data, can offer development opportunities to the clothing industry.

Once the research findings are published for the clothing industry, it is anticipated that this process may be utilised by design companies within the wider context, where human based products are being developed, for example the design of vehicle interiors and furnishings.

CONCLUSIONS

This programme of research has identified that the clothing industry appears to be considered as a combination of different elements, or sectors; design, manufacture and market. Little is known about the relationships which exist either within or between these sectors. This lack of understanding could relate to the industry wide reluctance of change that seems to have developed because of a number of factors, including rate of change of technology and the financial risk implications. Therefore, an appropriate approach was required with which to gain an insight into this complex industry.

The research method employed has been developed in order to use elicitation exercises followed by focus groups to access and utilise the high levels of

transferable tacit knowledge held across and between the clothing industry sectors. According to Jones (2002) research and development within the clothing sector is significantly under represented, especially in terms of application of newly available technologies. Therefore the researcher feels that broader reflection could identify further opportunities for the industry's development through the use of new technologies.

By considering other technological opportunities through the use of this process, it is proposed to enable appropriate new technologies to be acquired and applied more effectively. There is value to be gained in exploring opportunities within other academic and commercial fields, by developing project community to enhance opportunity identification and communication skills (Hilton).

If consideration is not given broadly to the value and implementation of bodyscan data, this technology may not fully achieve its potential across the clothing industry.

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Biography – Clare Hussey:

Clare Hussey has a UK clothing education background, starting in 1993 with an HND in Textiles & Clothing from Nottingham Trent, followed in 1995 by a two year top-up to BSc (Hons) in Applied Consumer Sciences at Northumbria University. Following this, in 1998 Clare obtained her MSc in Clothing (Advanced Manufacture) from Manchester Metropolitan University, Hollings. Her master's thesis was 'The role of the British clothing manufacturer in relation to the retailer', with research focussing on the decline of the UK clothing manufacturing industry due to the demands and control of the retail sector. On completion of her masters she worked for three years at Dewhirst (Ladieswear tailoring division) as a graduate trainee, at the time Dewhirst was one of the main suppliers of ladies tailoring to Marks & Spencer. Due to the decline of UK manufacturing base Clare left the industry embarking on a conversion MSc in Information Technology. In 2002 she began working in the Corporate Planning department at Northumbria University which involved analysing demographic student data. Through a combination of her awareness of clothing provision, with more in-depth knowledge of population demographics the realisation occurred that standard garments available on the high street was very limiting. Clare began her PhD in 2003.

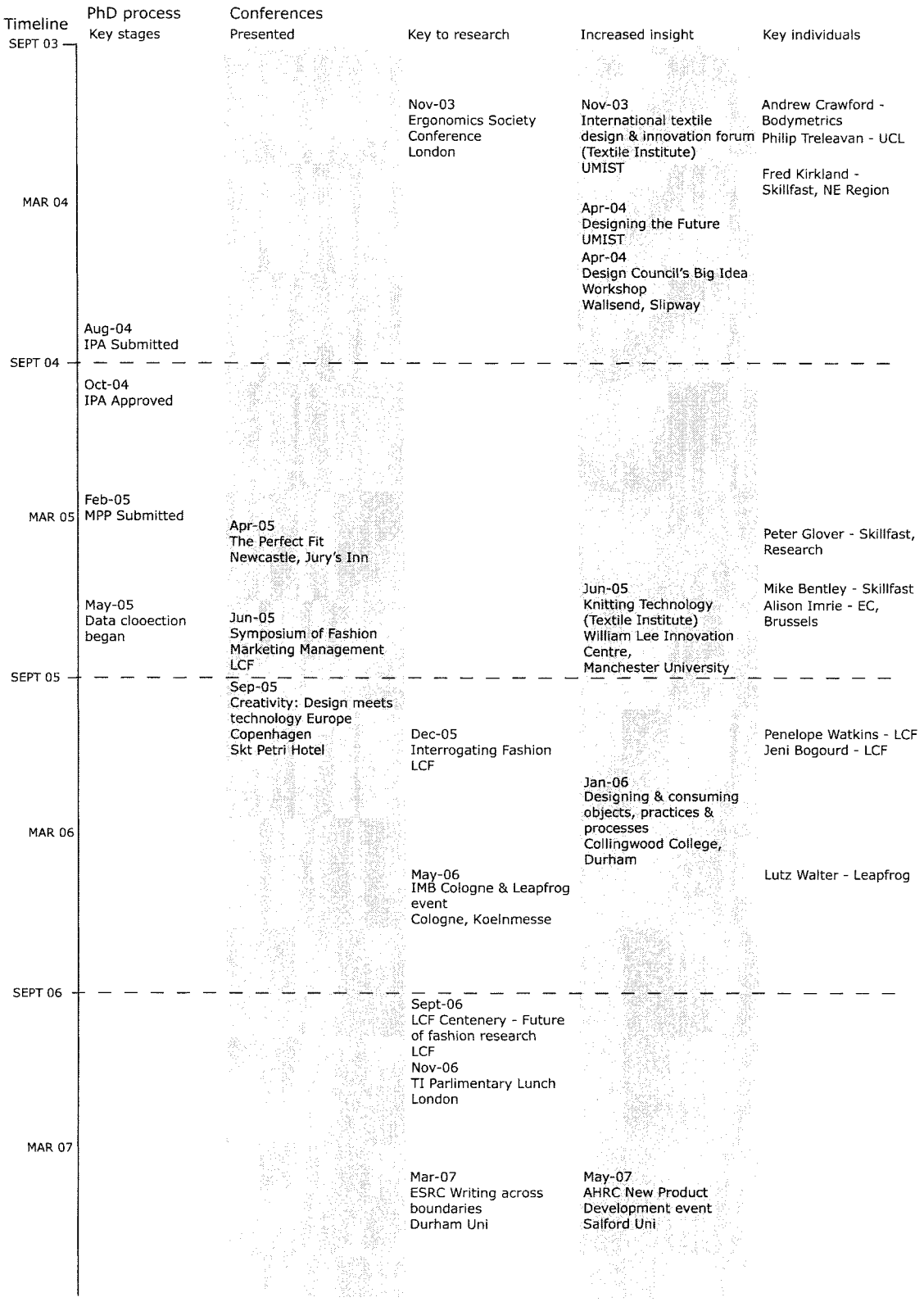
Conferences attended

This table has been included to show the conferences and additional pertinent events that were attended throughout the duration of the study. It outlines the year of study in which it occurred, where the event was held, whether the researcher was a delegate (D) or presenting (P), the title of the conference and the date the event took place.

Yr	Subject related conferences and talks			
1	London	D	Ergonomics conference	Nov-03
	UMIST	D	International textile design & innovation forum (Textile Institute)	Nov-03
	UMIST	D	Designing the Future	Apr-04
	Slipway, Wallsend	D	Design Council's Big Idea Workshop	Apr-04
2	Jury's Inn, Newcastle	P	The Perfect Fit	Apr-05
	William Lee Innovation Centre, Manchester	D	Knitting (TI)	Jun-05
	London College of Fashion (LCF)	P	Symposium of Fashion Marketing Management	Jun-05
3	Skt Petri Hotel, Copenhagen	P	Creativity: Design meets Technology Europe	Sep-05
	LCF	D	Interrogating Fashion	Dec-05
	Collingwood College, Durham	D	Designing & consuming objects, practices & processes	Jan-06
	Koelnmesse, Cologne		IMB Cologne, 2006	May-06
4	LCF		Helen Storey talk - Eye to I	Nov-06
	Salford University	D	New Product Development one day AHRC seminar	May-07

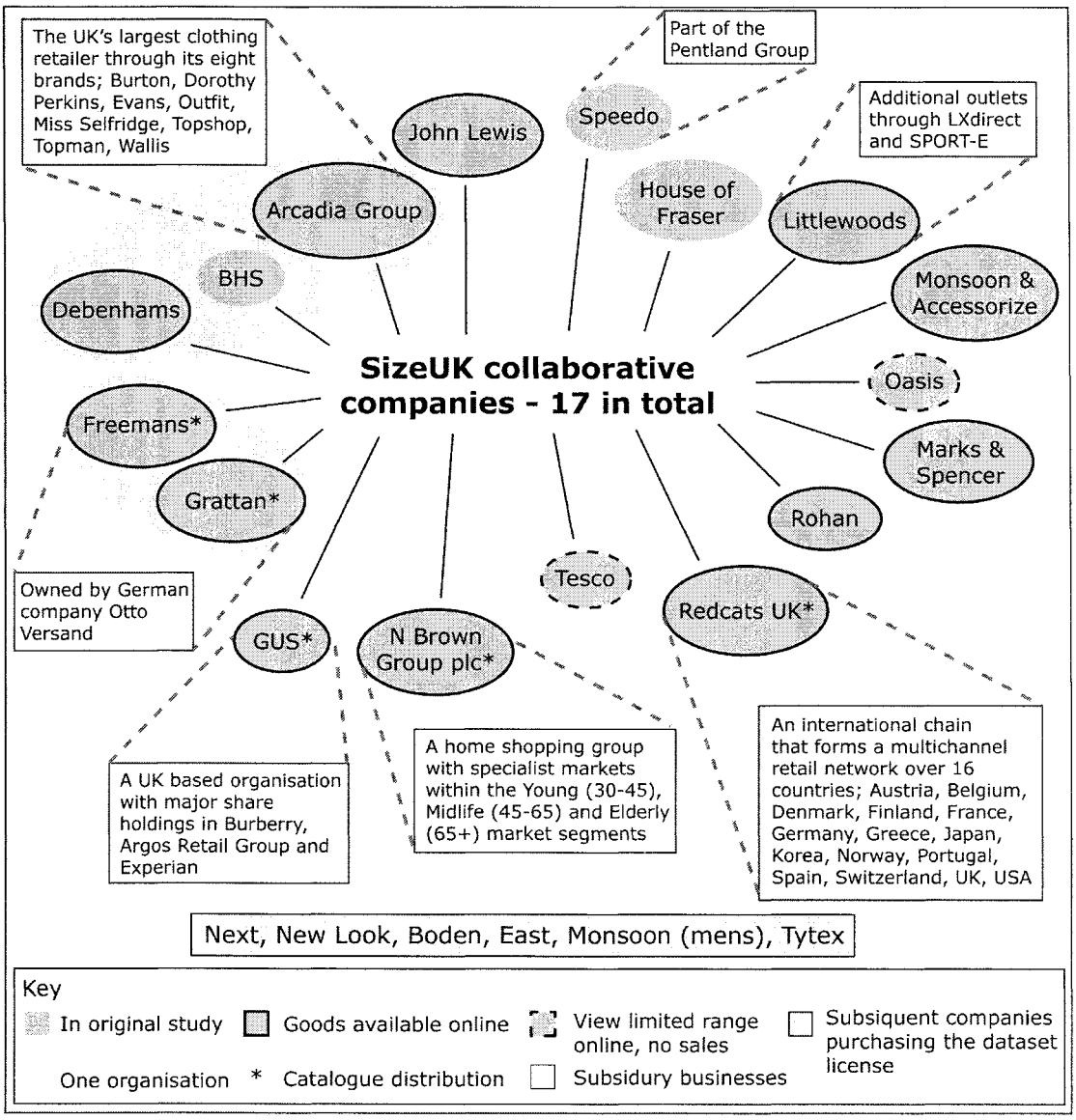
Yr	Additional external events		
1			
2	LCF	The Institutionalisation of knowledge	Mar-05
3	Bonnington Hotel, Bloomsbury	Careers in Focus: Acedemia	Jul-06
4	Houses of Parliament	Textile Institute Parlimentary lunch	Nov-06
	St Vincent De Paul Centre	Pecha Kucha event (DOTT 07)	Dec-06
	Durham University	Writing across bounderies	Mar-07

Key PhD stages, conference and key meeting timeline



Appendix 2 – Consideration of SizeUK retailers

This diagram was created by the researcher to further understand the companies that were involved in the SizeUK survey that was conducted during 2001. It was developed during 2004, and was devised to offer details of companies that are linked within larger corporations, details of companies approach to retail, and also organisations that subsequently purchased licenses to access the SizeUK data.



Appendix 3 – The UK Standard Industrial Classification (SIC) code system

The tables below have been taken from a web based source that outlines the UK Standard Industrial Classification of Economic Activities (UKSIC), this can be found on the National Statistics website www.statistics.gov.uk following the address details outlined in the reference SIC (2007). It has been included to illustrate the way in which the many different aspects of the clothing sector have been broken down, and then grouped together.

Division	Group	Class & Subclass	Description
SECTION D			**MANUFACTURING**
Subsection DB			MANUFACTURE OF TEXTILES AND TEXTILE PRODUCTS
17			MANUFACTURE OF TEXTILES
	17.1		Preparation and spinning of textile fibres
		17.11	Preparation and spinning of cotton-type fibres
		17.12	Preparation and spinning of woollen-type fibres
		17.13	Preparation and spinning of worsted-type fibres
		17.14	Preparation and spinning of flax-type fibres
		17.15	Throwing and preparation of silk including from noils and throwing and texturing of synthetic or artificial filament yarns
		17.16	Manufacture of sewing threads
		17.17	Preparation and spinning of other textile fibres
	17.2		Textile weaving
		17.21	Cotton-type weaving
		17.22	Woollen-type weaving
		17.23	Worsted-type weaving
		17.24	Silk-type weaving
		17.25	Other textile weaving
	17.3		Finishing of textiles
		17.30	Finishing of textiles
	17.4		Manufacture of made-up textile articles, except apparel

	17.40	Manufacture of made-up textile articles, except apparel
	17.40/1	Manufacture of soft furnishings
	17.40/2	Manufacture of canvas goods, sacks, etc.
	17.40/3	Manufacture of household textiles
17.5		Manufacture of other textiles
	17.51	Manufacture of carpets and rugs
	17.51/1	Manufacture of woven carpets and rugs
	17.51/2	Manufacture of tufted carpets and rugs
	17.51/3	This code is no longer in use
	17.51/9	Manufacture of other carpets and rugs
	17.52	Manufacture of cordage, rope, twine and netting
	17.53	Manufacture of non-wovens and articles made from non-
	17.54	wovens, except apparel
	17.54/1	Manufacture of other textiles not elsewhere classified
	17.54/2	Manufacture of lace
	17.54/3	Manufacture of narrow fabrics
	17.54/9	This code is no longer in use
		Manufacture of other textiles not elsewhere classified
17.6		Manufacture of knitted and crocheted fabrics
	17.60	Manufacture of knitted and crocheted fabrics
17.7		Manufacture of knitted and crocheted articles
	17.71	Manufacture of knitted and crocheted hosiery
	17.72	Manufacture of knitted and crocheted pullovers, cardigans and similar articles
18		MANUFACTURE OF WEARING APPAREL; DRESSING AND DYEING OF FUR
18.1		Manufacture of leather clothes
	18.10	Manufacture of leather clothes
18.2		Manufacture of other wearing apparel and accessories
	18.21	Manufacture of workwear
	18.22	Manufacture of other outerwear
	18.22/1	Manufacture of other men's outerwear
	18.22/2	Manufacture of other women's outerwear
	18.23	Manufacture of underwear
	18.23/1	Manufacture of men's underwear
	18.23/2	Manufacture of women's underwear
	18.24	Manufacture of other wearing apparel and accessories
	18.24/1	not elsewhere classified
	18.24/2	Manufacture of hats
	18.24/3	This code is no longer in use
	18.24/9	Cut, make and trim for clothing manufacturers (CMT)
		Manufacture of other wearing apparel and accessories not elsewhere classified
18.3		Dressing and dyeing of fur; manufacture of articles of fur

		18.30	Dressing and dyeing of fur; manufacture of articles of fur
Subsection DC			MANUFACTURE OF LEATHER AND LEATHER PRODUCTS
19			TANNING AND DRESSING OF LEATHER; MANUFACTURE OF LUGGAGE, HANDBAGS, SADDLERY, HARNESS AND FOOTWEAR
	19.1		Tanning and dressing of leather
		19.10	Tanning and dressing of leather
	19.2		Manufacture of luggage, handbags and the like, saddlery and harness
		19.20	Manufacture of luggage, handbags and the like, saddlery and harness
	19.3		Manufacture of footwear
		19.30	Manufacture of footwear
51			WHOLESALE TRADE AND COMMISSION TRADE, EXCEPT OF MOTOR VEHICLES AND MOTORCYCLES
	51.4		Wholesale of household goods
		51.41	Wholesale of textiles
		51.42	Wholesale of clothing and footwear
		51.42/1	Wholesale of adults' fur and leather clothing
		51.42/2	Wholesale of children's and infants' clothing
		51.42/3	Wholesale of footwear
		51.42/9	Wholesale of clothing not elsewhere classified
52			RETAIL TRADE, EXCEPT OF MOTOR VEHICLES AND MOTORCYCLES; REPAIR OF PERSONAL AND HOUSEHOLD GOODS
	52.4		Other retail sale of new goods in specialised stores
		52.41	Retail sale of textiles
		52.42	Retail sale of clothing
		52.42/1	Retail sale of adults' fur and leather clothing
		52.42/2	Retail sale of children's and infants' clothing
		52.42/3	Retail sale of other women's clothing
		52.42/4	Retail sale of other men's clothing
		52.43	Retail sale of footwear and leather goods
		52.43/1	Retail sale of footwear

Appendix 4 – Examples of questionnaires

The following pages show the documents distributed for each data collection phase;

E1 P1 Preparatory exercise

E2 P1 Industry specific technology suppliers

E3 P1 High street retail sector

Preparatory exercise - Eliciting process knowledge

This is a two-part exercise; completion of Part 1 prepares for Part 2.

Instructions – Part 1:

Consider all the lists of critical ***aspects*** on the following page and add detail as follows:

1. Please add any additional words you consider relevant.
2. Underline those that you feel are key ***aspects*** of that process.
3. From the selected words that you have underlined;
   a. Circle ***aspects*** where the use of standard body size measurement is utilised
   b. Identify the ***aspects*** that could/would be influenced by the use of the bodyscan[11] data using an asterisk (*)

Process Specialism		*aspects*
MANUFACTURE:		***raw materials, machinery, planning, quantities, finished goods, production lines, operators, size ratios, deadlines, seconds...***
	Additional:	
DESIGN:		*trends, colour, styles, pattern blocks, computers, pattern grading, target customers, past products, inspiration...*
	Additional:	
MARKET:		***retailers, consumers, outlet, internet, stock, sales, profit/loss, location, targets, trends, size ratios, availability...***
	Additional:	
TECHNOLOGY - DATA PROCESSING & STORAGE:		*communication, EPOS, stock control, new processes, pattern grading, data storage, computerised cutting, WIP system, highly technical, large amounts of data, expensive to access, restrictive, under utilised ...*
	Additional:	

Instructions – Part 2:

Using your personally amended list, use the next page to draw two process diagrams as detailed below. Use as much detail as you feel necessary - In both cases, use text size to stress importance, arrows to signify data flow or relationships:

1. Diagram 1. should show the ***aspect*** relationships within your own area of specialism, for this use each key ***aspect***.

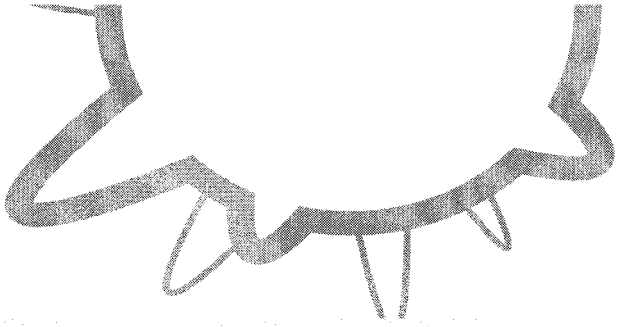
2. Diagram 2. will show your perception of how each element of the **process specialism** (manufacture, design, market and technology) areas work together, add any other influencing factors.

[11] Bodyscan data refers to the SizeUK dataset (held by Bodymetrics) that was compiled as a result of the National Sizing Survey in 2001, in which 11,000 people across the UK were 3D digitally scanned.

Process Diagram 1: Industry sector

Process Diagram 2: SME clothing manufacturing process

The Centre for **Design Research**



Technology Provider Questionnaire

Organization: .....

Contact name: .....

Company originates: .....

Main countries supplied: .....

Approximate number of Clients: ..... Approximate number of SME Clients: .....

1. Indicate available IT services (indicate with an '**x**')

Design & Product Development	Retail	Sourcing, Logistics & Transport	Information Technology	Manufacturing Technology
☐	☐	☐	☐	☐

2. Do you offer a 'lite' version of your system?

Yes	No	Possibly
☐	☐	☐

3. Are your products clothing industry specific?

Yes	No
☐	☐

4. Level of system complexity

Simple	General	Technical	Combination
☐	☐	☐	☐

5. Identify main source of sales generation

Advertising	Trade fair	Recommendation	Other
☐	☐	☐	.....

6. Please indicate entry level specification and price

	Price
Standard	
Lite	

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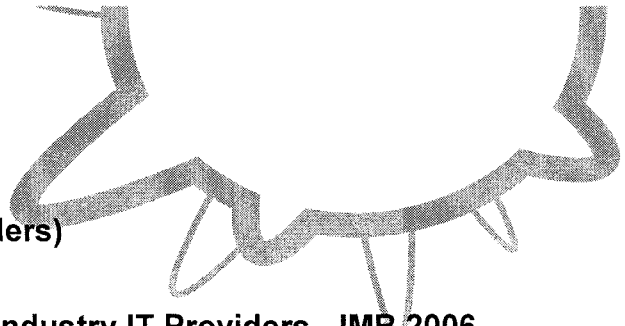
Tel: 0191 227 4214 Fax: 0191 227 3148 www.cfdr.co.uk/clarehussey/imb2006.doc



Research rationale (Technology providers)

Questionnaire for Clothing & Fashion Industry IT Providers - IMB 2006 Cologne

PhD Researcher: Clare Hussey

Summary

Completing this short questionnaire, developed to extract basic product information from clothing industry IT providers, will enable the researcher to identify the product information key to individual organisations. Data compiled from this research at IMB 2006 will be used in the generation of a prototype 'resource identification tool' to aid businesses, especially within micro, small and medium sized companies across the fashion and clothing industries in order to identify appropriate industry specific technologies.

Background

Responding to this enquiry will enable the generation of a process analysis tool, and will form a vital component of the PhD research programme entitled 'An investigation of clothing industry interrelationships and attitudes towards new technological development and adoption'. Attending IMB 2006 gives the opportunity to further investigate the breadth of services and facilities internationally available from the diverse selection of IT providers.

Plan of Work

There are two intended means by which to collect the data. The first involves the researcher approaching IT providers prior to the event via the Business Matchmaking facility. In addition, the researcher will have the opportunity to approach company stands within the trade fair environment. The short questionnaire will be made available electronically as a Word document posted on the Centre for Design Research (CfDR) website, allowing it to be returned electronically using email or by facsimile.

The content of the questionnaires has been driven by research previously conducted within the PhD programme, combined with key elements from the Apparel feature article 'Vendor background and solution information' (Speer, 2005). It is expected that responses obtained will generate further, more informed lines of enquiry appropriate to the creation of the resource identification tool.

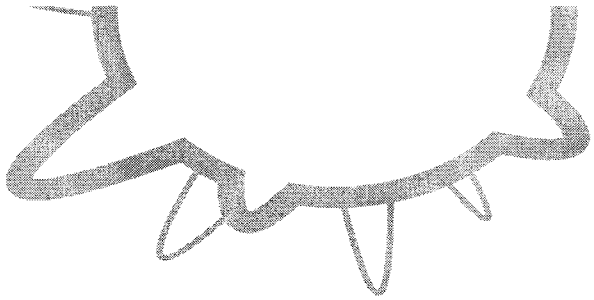
Ethical implications

This form of data collection does not require personal details to be collected, therefore has no implications to individuals involved in the query. However it is recognised by the researcher that included within the questionnaire are questions that could be considered confidential to a business. Any organisations partaking in this research can be assured that all data compiled is purely for research purposes.

Reference

Speer J. K., 2005, *Vendor background and solution information*, Apparel, September 2005, 26-39

The Centre for **Design Research**



Retail sector questionnaire

Organization: .....

Contact name: .....

Position within company: .....

Email ..... Telephone .....

Company (parent) originates: .....

Main countries supplied: .....

Approximate number of Stores: ..... Approximate number outlets overseas: .....

1a. Indicate IT services used by your organisation (indicate with an '**x**')

Design & Product Development	Retail	Sourcing, Logistics & Transport	Information Technology	Manufacturing Technology	Accountancy Software	Innovative Technologies
☐	☐	☐	☐	☐	☐	☐

1b. Please list suppliers of each service

Design & Product Development .....

Retail .....

Sourcing, Logistics & Transport .....

Information Technology .....

Manufacturing Technology .....

Accountancy Software .....

Innovative Technologies .....

1c. Are the systems integrated? Yes ☐ No ☐ Some ☐

1d. Do you require your suppliers to use compatible systems? Yes ☐ No ☐ Possibly ☐

1e. Please add any additional comments relating to technologies used.

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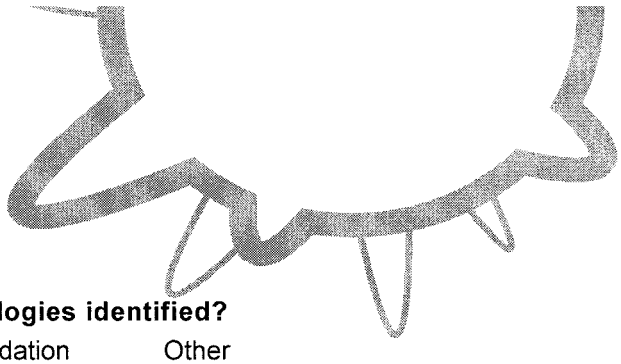
Northumbria University is the trading name of University of Northumbria at Newcastle

The Centre for **Design Research**

Technology Provider Questionnaire



2a. How, as an organization are new technologies identified?

Advertising	Trade fair	Recommendation	Other
☐	☐	☐	_____

2b. Are selections dictated by financial budgets? Yes ☐ No ☐

0a. Focusing on SizeUK data, have findings been applied to current garment ranges Yes ☐ No ☐ In the future ☐

0b. Have fit models or standard pattern blocks been altered as a result of SizeUK dataset usage Yes ☐ No ☐ In the future ☐

0c. Has use of the data affected the number of sales returns for fit? Yes ☐ No ☐ Not yet proven ☐

0d. Has using the data improved provision of garments to the non-standard consumer market segments? Such as petite, tall, outsize, elderly. Yes ☐ No ☐ ? ☐ Not yet proven ☐

0e. Has involvement in the SizeUK study been worthwhile for your organisation? Yes ☐ No ☐ Not yet proven ☐

0f. Please add any additional comments relating to use of digital bodyscan data.

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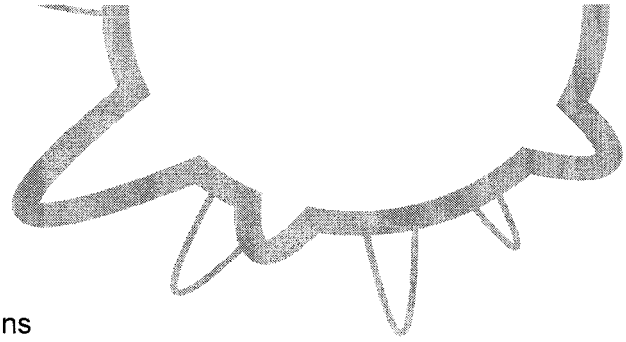
Northumbria University is the trading name of University of Northumbria at Newcastle



Research rationale (Retailers)

Questionnaire for UK retail sector organisations

PhD Researcher: Clare Hussey

This research programme has evolved from the researchers experience and interest in development of the clothing industry. Educated to MSc level with a predominant clothing focus, insights were gained into garment construction methods, design processes and considerations, ergonomics, anthropometrics and demographics. Clothing industry experience was gained during three years as a management trainee at a large UK based manufacturer. A combination of practical industry knowledge with increased insight into population demographics resulted in a question arising as to the provision of clothing for an increasingly non-standard population. This research will investigate the potential opportunities to be gained for clothing provision through the use of new technologies across the UK clothing industry.

Summary

Completing this short questionnaire developed to enable the researcher to identify product application information key to individual retail organisations. Data compiled from this research will be used in gain an insight into different technologies used across the sector.

Background

Responding to this enquiry will increase the researchers understanding of the identification and application processes utilised within the large retail organisation environment. The findings will form a vital component of the PhD research programme entitled 'An investigation of clothing industry interrelationships and attitudes towards new technological development and adoption'.

Plan of Work

There are two intended means by which to collect the data. The first involves the completion of a short questionnaire, available electronically as a Word document posted on the Centre for Design Research (CfDR) website allows it to be returned electronically using email or by mail or facsimile. The content of the questionnaires has been driven by research previously conducted within the PhD programme, combined with key elements from the Apparel feature article 'Vendor background and solution information' (Speer, 2005). It is expected that responses obtained will generate further, more informed lines of enquiry. In addition, a representative proportion of respondents will be approached to partake in a further short interview relevant to the research subject.

Ethical implications

This form of data collection does not require personal details to be collected, therefore has no implications to individuals involved in the query. However it is recognised by the researcher that included within the questionnaire are questions that could be considered confidential to a business. Any organisations partaking in this research can be assured that all data compiled is purely for research purposes.

Speer J. K., 2005, *Vendor background and solution information*, Apparel, September 2005, 26-39

Appendix 5 – E1 P1 Word lists

Design sector

Words
Colour
Computers
Inspiration
Past products
Pattern blocks
Pattern grading
Styles
Target customers
Trends

Additional Words	Count
Ability to travel	1
Back-up team	1
CAD system	1
Commerciality	0
Costings	1
Critical path	1
Deadlines	1
Detail	1
Development	1
Fabrics	2
Fit	5
Heritage	1
Innovation	1
Job Satisfaction	1
Key customers	1
Launch	1
Location of mfr	1
Pre-production meetings	1
Production liason	1
Quality	1
R&D	1
Research - books, magazines	1
Research trips	1
Review	1
Samples	2
Sealed samples	1
Seasonal	1
Sizing	1
Socio-economic (World Cup)	1
Source	1
Swatches	1
Trims/accessories	1

Manufacture sector

Words
Deadlines
Finished goods
Machinery
Operators
Planning
Production lines
Quantities
Raw Materials
Seconds
Size ratios

Additional Words	Count
Achieve delivery schedule	1
B stock	1
Consistant	1
Continuous Improvement - Kaizen	1
Costings	1
Critical path	2
Delivery	1
Design	2
Efficiency	1
Fit	1
Forcasting	1
Good communication	1
Health & Safety	1
Key performance indicators	1
Lean manufacture	2
Location	1
Margin	1
Objectives	1
Offshore	1
Overseas duties	1
Overseas freight	1
Pattern grading	2
Performance review	1
Price	1
Problem solving	1
Quality	5
Quality assurance	1
Quality control	1
Quota	1
Ratings/Utilisation	1
Right first time	1
Skills shortage	1
Supply chain	2
Team work	1
Transportation	1
Turnaround	1
WIP	1
Work Study	1

Market sector

Words
Availability
Consumers
Internet
Location
Outlet
Profit/loss
Retailers
Sales
Size ratios
Stock
Targets
Trends

Additional Words	Count
Best product possible	1
Buying behavior	1
Collections	1
CRM	1
Customer feedback	1
Customer segmentation	1
Customer service	1
Delivery performance	1
Different markets - Europe, Asia	1
Discerning attitudes	1
Evening in house sales	1
Export	1
International	1
Niche	1
Packaging design	1
Planning	1
Point of sale method	1
Price	1
Price architecture	1
Promotion	1
Ranges	1
React to customer	1
Repeat business	1
Returns	2
Sales agents	1
Sales reviews	1
Service	1
Supplier sell through	1

Technology

Words
Communication
Computerised cutting
Data storage
EPOS
Expensive to access
Highly technical
Large data capacity
New processes
Pattern grading
Restrictive
Stock control
Under utilised
WIP System

Additional Words	Count
Bestsellers	1
CAD	2
CAM	1
Difficulty	1
Fast react planning	2
Ideal stock	1
KEA system	3
Lack of syncronisation	1
Logistics	2
PDM system	3
Store communications	1

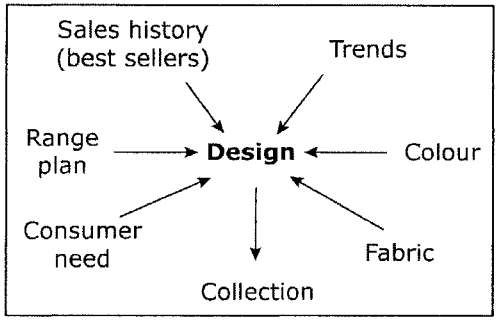
Focus group word list choice analysis

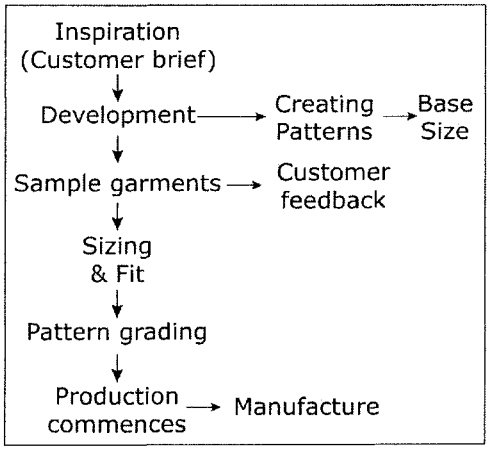
Red – Design Green – Manufacture Blue – Market **Bold** – Key choice Normal – Secondary choice

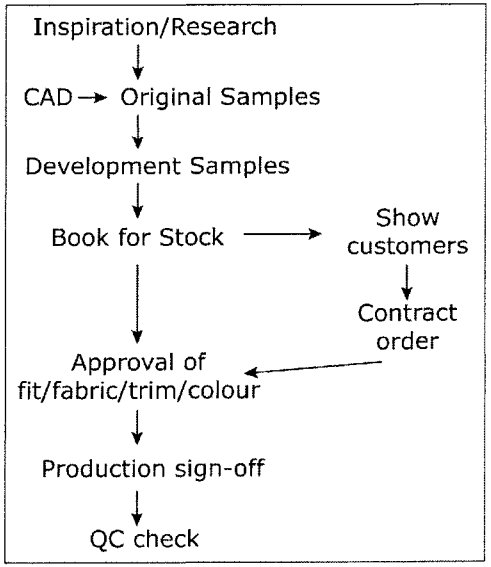
Sector	Word lists in order
mf	**Achieve delivery schedule**
mk	Availability
mk	Availability
mk	Availability
d	**Back-up team**
mk	Buying behaviour
mk	Buying behaviour
t	CAD
t	**CAM**
d	Colour
d	Commerciality
d	Commerciality
t	**Communication**
t	**Communication**
d	**Computers**
d	Computers
mk	**Consumers**
mf	Continuous Improvement – Kaizen
d	Costings
d	Costings
mk	CRM
mk	Customer feedback
mk	**Customer segmentation**
mk	Customer service
mk	Customers
t	**Data storage**
d	Deadlines
mf	**Design**
mf	Design
d	Detail
mk	**Different markets - Europe, Asia**
mk	**Different markets - Europe, Asia**
mf	Efficiency
mf	Efficiency
t	EPOS
d	Fabrics
d	Fabrics
t	**Fast react planning**
d	Fit
d	Fit
mf	Fit
mf	Good communication
mf	Good communication
d	**Innovation**
d	Innovation
d	Innovation
d	**Inspiration**
d	**Inspiration**

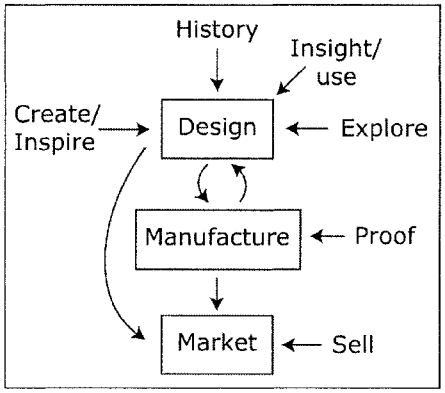
Sector	Word lists in order
d	Inspiration
mf	Lean manufacture
mk	Location
mk	Location
mf	Machinery
mf	Margin
mk	Niche
mk	Niche
mf	Objectives
mf	**Offshore**
d	Pattern grading
t	Pattern grading
t	**PDM system**
mk	Planning
mk	Price
mk	Price
mk	Price
mk	**Profit/loss**
mk	**Profit/loss**
mk	**Profit/loss**
mk	**Promotion**
mf	**Quality**
mf	**Quality**
mf	Quality assurance
mk	Ranges
mk	Ranges
mk	**React to customer**
mf	Right first time
mk	**Sales**
mk	Sales
d	**Samples**
d	**Sealed samples**
mk	Service
mk	Service
mk	Service
mf	Size ratios
d	**Sizing**
d	Source Swatches
mk	Stock
d	Styles
d	Styles
mf	Supply chain
d	**Target customers**
d	Target customers
mf	**Team work**
d	**Trends**

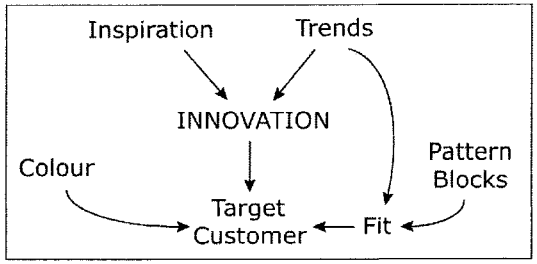
(original in colour)

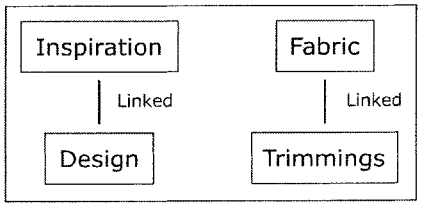

Sales history
(best sellers)
Trends
Range
plan
Design
Colour
Consumer
need
Fabric
Collection


Inspiration
(Customer brief)
Development
Creating
Patterns
Base
Size
Sample garments
Customer
feedback
Sizing
& Fit
Pattern grading
Production
commences
Manufacture

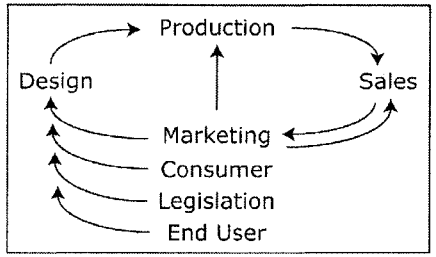

Inspiration/Research
CAD
Original Samples
Development Samples
Book for Stock
Show
customers
Contract
order
Approval of
fit/fabric/trim/colour
Production sign-off
QC check


History
Insight/
use
Create/
Inspire
Design
Explore
Manufacture
Proof
Market
Sell


Inspiration
Trends
INNOVATION
Colour
Pattern
Blocks
Target
Customer
Fit


Inspiration
Fabric
Linked
Linked
Design
Trimmings

Mf1



Mf2

Forcasting/Planning

Purchasing

Cutting

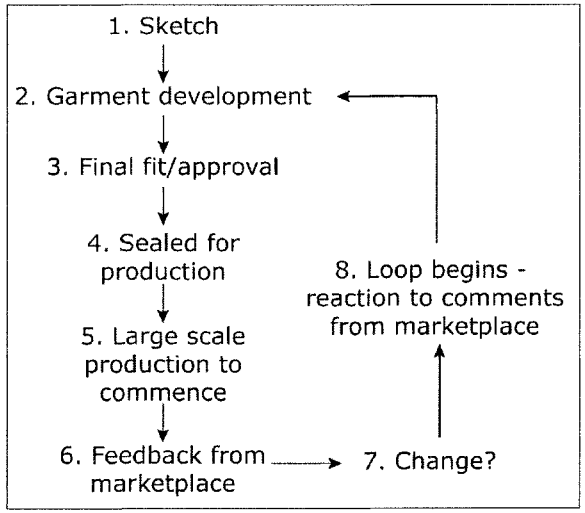
Manufacture

Recruitment

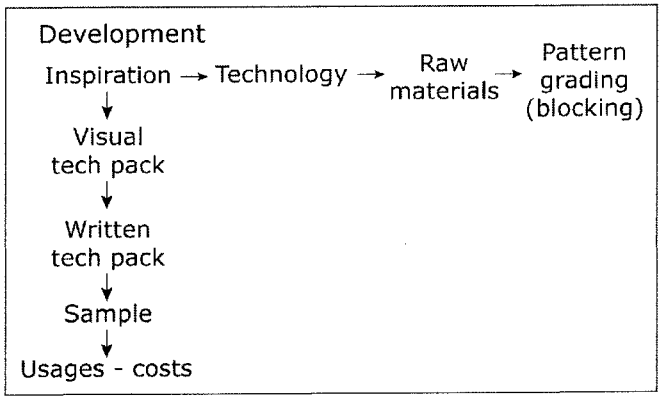
Equipment & Services

No links were identified in this diagram

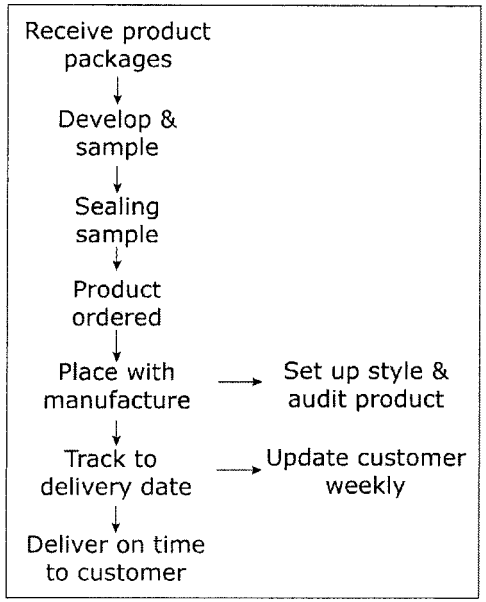
Mf3



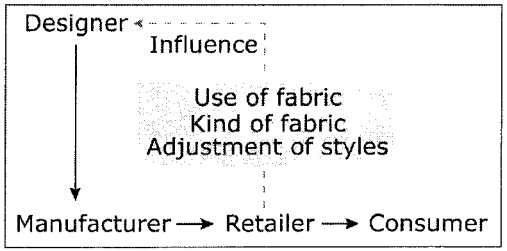
Mf4



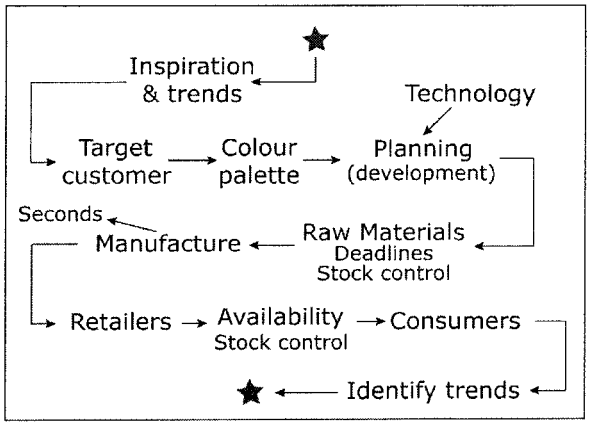
Ma1



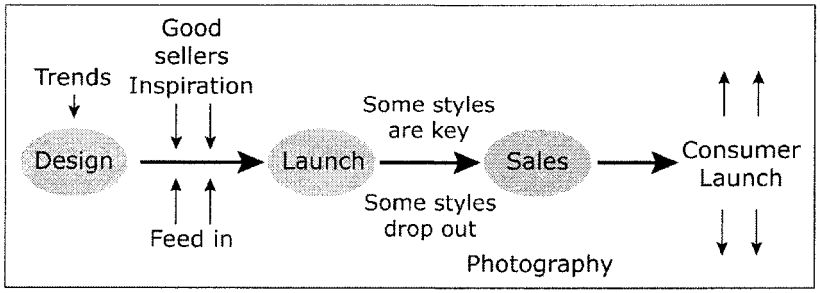
Ma2



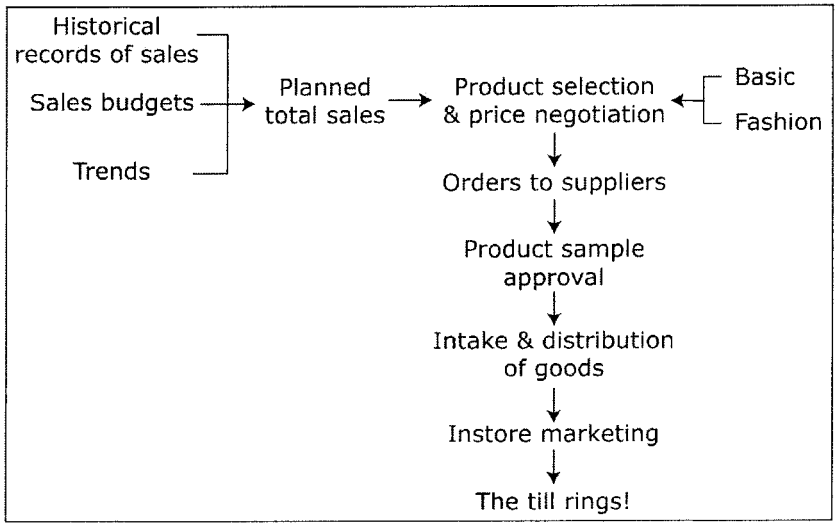
Ma3



Ma4



Ma5



Appendix 7 – E1 P1 Industry overview diagrams

Industry Overview - Design

Mf5

1. Bulk Manufacture

Plan → Material Purchase → Bulgaria → Base → Assemble against orders → Out

Foam purchase → Base

2. Small niche quantities

Stock material & foam maintained → Orders received → Production planning → Manufacture in-house or outworker → Assemble → Dispatch

Mf6

1. MARKET	Consumer needs, expectation, profile
2. DESIGN	Market trend, inspiration, to give customers what is expected from Barbour, newness, niche, new ranges - a must to keep customers interested
3. MANUFACTURE	Provide an all encompassing service to the business of quality, cost to agreed timetables & seasonal demands

Percieved order but no links were identified in this diagram

Mf7

MARKET	Feedback, lack of/success of previous styles, stock holdings
DESIGN	Links both ways to sales & production to established what the customer wants and what the supplier can achieve
PRODUCTION	Once agreed with sales (market) and design - quantities/quality/delivery and efficiency have to be met

Percieved order but no links were identified in this diagram

Mf8

Production

Sample = Tech pack minutes → Buying → Raw materials → Planning

↓

Cutting → Sorting → Bundling

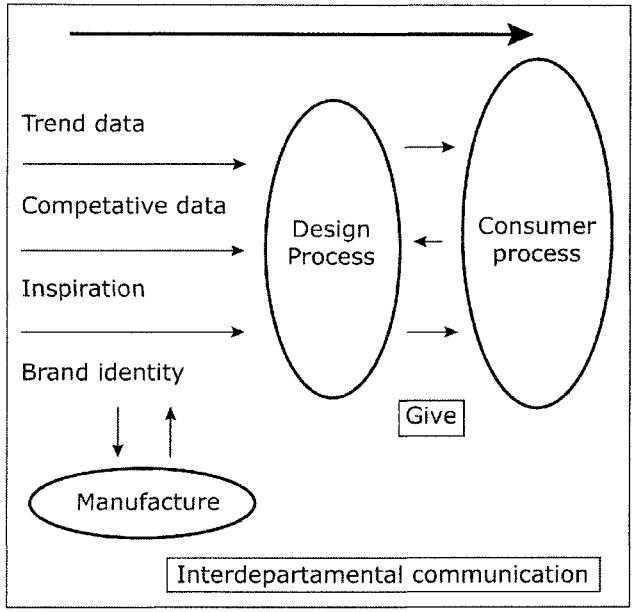
↓

Sewing = Inline quality → Final QC control

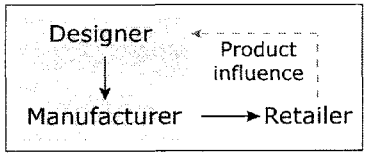
↓

Final audits

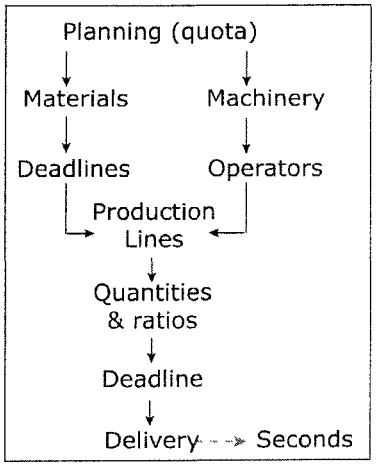
Ma6



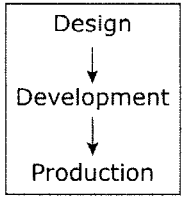
Ma7



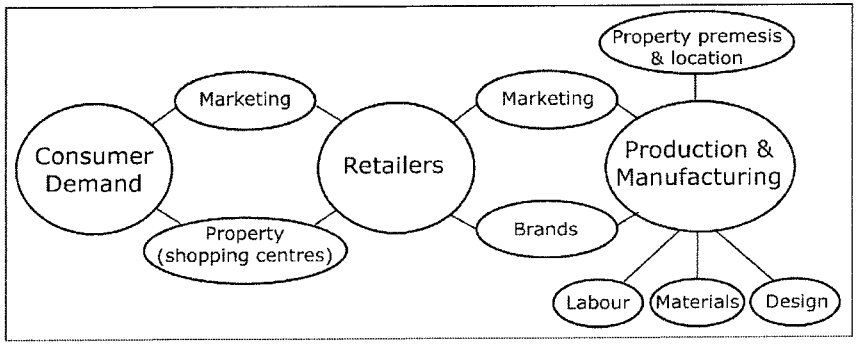
Ma8



Ma9



Ma10



Appendix 8 – Diagram analysis 'How many times'

Sector Overview
Diagrams D1-D6

	Count
Inspiration	**4**
Design	**3**
Pattern blocks/grading	**3**
Colour	2
Customer feedback	2
Development	2
Fabric	2
Fit & sizing	2
Production	2
Samples	2
Trend	2
Trim	2

Industry Overview
Diagrams D7-D12

	Count
Market(ing)	**6**
Design	**6**
Manufacture	**5**
Sales	**3**
Consumers	2
Fit/Sizing	2
Pattern Grading	2
QC	2
Range	2
Raw Materials	2
Shipping/logistics	2
Stock	2
Technology	2

Sector Overview
Diagrams Mf1-Mf5

	Count
Production/Manufacture	**3**
Development	**2**
Feedback	**2**

Industry Overview
Diagrams Mf6-Mf10

	Count
Manufacture/Assembly	**5**
Dispatch/delivery	**3**
Material	**3**
Plan	**3**
Quality/QC	**3**
Consumer	2
Design	2
Market	2
Stock material	2

Sector Overview
Diagrams Ma1-Ma5

	Count
Consumer	**4**
Trends	**4**
Sales	**3**
Samples	**3**
Designer	2
Inspiration	2
Manufacture confirmed	2
Manufacturer	2
Marketing/Photography	2
Retailer	2

Industry Overview
Diagrams Ma6-Ma10

	Count
Manufacture/production	5
Brand identity	2
Design	4
Retailer	3
Consumer	2
Materials	2
Operators/labour	2
Seconds	2

Appendix 9 - E2 P1 Technology providers data

	Organization	Company originates	Main countries supplied	Approx. no. clients	Approx. no. SME clients
1	Gerber Technology	Germany	Worldwide, China, Vietnam, India, Pakistan, Russia, Ukrain, Egypt	25,000	In UK, the majority, design houses sub contracting
2	Lectra	France	Italy, France, UK, China	17,000	Less than 50%
3	PTC (Parametric Technology UK Ltd)	Evolved from PDM used in Boeing, adapted in 1990's for clothing	Global, US, UK, Germany, Italy, France	12 enterprise clients	Varies
4	Optitex	Israel	Worldwide	15,000 installations	
5	Visual Retailing	Dutch, UK, US	US, Netherlands, Germany, Italy, France	50	90% SMEs
6	Infor	US	Europe, US, Asia, Australasia	500	
7	Option Systems	UK	50% UK, 50% Global, US, SA, Australia, Sri Lanka, Holland	110	About 50%
8	Pebblestone	Netherlands	Global, 25 countries	189	
9	Alva Products	US	US, Canada, UK, Germany (Global)	200	Mainly large
10	Blue Fox Ned Graphics	Netherlands	Global	4,000	Most are SME
11	Koppermann (Tex-Data)	Germany	EC, US, India, Thiland, Malaysia	600, with 6,000 installations	Varies, 1-400
12	GenCom	Belgium	Belgium, Netherlands, Portugal	500	350 SME, 150 Larger
13	Telmat Industrie (SYMCAD)	France	Europe, China, Teran, various armed forces	35	
14	Human Solutions GmbH	Germany	Germany, US	500	50% Mass Cust, 50% armed forces
15	E-Measurement Solutions Ltd	UK	Increasingly global, more Asia & Africa, US (Walmart)		
16	Blackman & White	UK	Global, EC, US, China, Russia	500	Varies
17	Microsoft Germany GmbH	UK	Germany, Switzerland, Austria		
	Totals:				

	Organization	Question 1 IT services provided by company					
		Design & Prod. Dev.	Retail	Sourcing, logistics & transport	IT	Mfr. Tech.	Comment
1	Gerber Technology	1	1	0	0	1	The retail option is using PDM.
2	Lectra	1	1	1	0	1	Retail is PDM/PLM, Sourcing, Logistics & Transport PLM
3	PTC (Parametric Technology UK Ltd)	1	1	1	1	0	Logistic & transport are not included
4	Optitex	1	1	0	0	0	
5	Visual Retailing	0	1	0	1	0	
6	Infor	1	0	1	1	1	Retail - small ammount, Sourcing, not logistics & transport
7	Option Systems	1	1	1	1	0	
8	Pebblestone	1	1	1	0	1	System works with Microsoft package
9	Alva Products	1	0	0	0	0	Mfr Tech - small ammount
10	Blue Fox Ned Graphics	1	0	0	0	1	
11	Koppermann (Tex-Data)	1	1	0	1	0	
12	GenCom	0	1	0	1	1	
13	Telmat Industrie (SYMCAD)	0	0	0	1	1	
14	Human Solutions GmbH	1	1	1	1	0	Not sourcing & transport
15	E-Measurement Solutions Ltd	1	1	1	1	1	
16	Blackman & White	0	0	0	0	1	
17	Microsoft Germany GmbH	0	0	0	1	0	IT - platform
	Sum Total:	**12**	**11**	**7**	**10**	**9**	
	Count	17	17	17	17	17	
	% of total	**71%**	**65%**	**41%**	**59%**	**53%**	

	Organization	Question 2 Is a 'lite' version available				
		Yes	No	Possibly	N/A	Comment
1	Gerber Technology	1	0	0	0	
2	Lectra	0	0	0	1	N/A as the system is modular
3	PTC (Parametric Technology UK Ltd)	1	0	0	0	
4	Optitex	1	0	0	0	One version is for free
5	Visual Retailing	0	0	1	0	
6	Infor	0	1	0	0	
7	Option Systems	1	0	0	0	
8	Pebblestone	1	0	0	1	Module based, can be user based
9	Alva Products	0	0	0	0	
10	Blue Fox Ned Graphics	1	0	0	0	
11	Koppermann (Tex-Data)	0	1	0	0	3 ver available, 3 products PDM Lite or sophisticated diff d/base. Design 3 ver std/classic/professional
12	GenCom	1	0	0	0	
13	Telmat Industrie (SYMCAD)	1	0	0	0	
14	Human Solutions GmbH	1	0	0	0	
15	E-Measurement Solutions Ltd	0	0	0	1	N/A
16	Blackman & White	0	0	0	1	
17	Microsoft Germany GmbH	0	0	0	1	
	Sum Total:	**9**	**2**	**1**	**5**	
	Count	17	17	17	17	
	% of total	**53%**	**12%**	**6%**	**29%**	

	Organization	Question 3 Clothing industry specific?		
		Yes	No	Comment
1	Gerber Technology	0	1	45% outside clothing, in automotive & technical textiles
2	Lectra	0	1	Clothing, finishing & soft goods
3	PTC (Parametric Technology UK Ltd)	1	0	
4	Optitex	0	1	
5	Visual Retailing	0	1	
6	Infor	1	0	
7	Option Systems	1	0	
8	Pebblestone	1	0	
9	Alva Products	1	0	
10	Blue Fox Ned Graphics	0	1	Also textiles & floor covering
11	Koppermann (Tex-Data)	0	1	Co. originates as a fabric (greige) suppliers, also soft furnishings
12	GenCom	0	1	Also shoes
13	Telmat Industrie (SYMCAD)	1	0	
14	Human Solutions GmbH	0	1	
15	E-Measurement Solutions Ltd	0	1	
16	Blackman & White	1	0	
17	Microsoft Germany GmbH	1	0	
	Sum Total:	**8**	**9**	
	Count	17	17	
	% of total	**47%**	**53%**	

	Organization	Question 4 Level of complexity				
		Simple	General	Technical	Combination	Comment
1	Gerber Technology	1	1	1	1	
2	Lectra	1	0	1	1	Devised for customer requirements
3	PTC (Parametric Technology UK Ltd)	0	0	0	1	
4	Optitex	1	0	0	0	
5	Visual Retailing	1	0	0	0	
6	Infor	1	0	0	0	
7	Option Systems	0	0	0	1	Elements are simplified
8	Pebblestone	1	0	0	0	
9	Alva Products	1	0	0	0	
10	Blue Fox Ned Graphics	0	0	0	1	The standard is simple
11	Koppermann (Tex-Data)	1	0	0	0	
12	GenCom	0	0	0	1	
13	Telmat Industrie (SYMCAD)	1	0	0	0	
14	Human Solutions GmbH	1	0	1	1	Some simple & technical, depends on solution
15	E-Measurement Solutions Ltd	1	0	0	0	
16	Blackman & White	1	1	0	0	
17	Microsoft Germany GmbH	0	0	1	0	
	Sum Total:	**12**	**2**	**4**	**7**	
	Count	17	17	17	17	
	% of total	**71%**	**12%**	**24%**	**41%**	

	Organization	Question 5 Main source of sales				
		Advertising	Trade Fair	Recommendation	Other	Comment
1	Gerber Technology	1	1		0	
2	Lectra	0	0	0	0	Advertising - none/little, Trade Fair - for repeat customers. Customers seek Lectra out
3	PTC (Parametric Technology UK Ltd)	0	1	0	1	Trade fairs & events, Other - direct interfacing
4	Optitex	0	0	1	0	
5	Visual Retailing	0	1	1	1	Other - Cold calling, magazine articles, consultant, partnership
6	Infor	0	1	1	0	
7	Option Systems	1	0	1	0	Advertising - web
8	Pebblestone	0	0	1	0	
9	Alva Products	0	0	1	0	
10	Blue Fox Ned Graphics	0	0	0	1	Other - Agents
11	Koppermann (Tex-Data)	0	0	1	0	
12	GenCom	0	1	1	0	
13	Telmat Industrie (SYMCAD)	0	0	1	0	
14	Human Solutions GmbH	0	1	1	0	Advertising - small ammount
15	E-Measurement Solutions Ltd	0	1	1	0	Advertising - will in the future
16	Blackman & White	1	1	1	0	Advertising 1, Trade fair 3, Recc 2
17	Microsoft Germany GmbH	0	0	0	0	
	Sum Total:	**3**	**8**	**12**	**3**	
	Count	17	17	16	17	
	% of total	**18%**	**47%**	**75%**	**18%**	

	Organization	Question 6 Entry level price			
		Standard	Lite	Modular hard to price	Comment
1	Gerber Technology			1	
2	Lectra	£2,000		1	Design Industry
3	PTC (Parametric Technology UK Ltd)			1	Depends on the level of specification required by the user
4	Optitex			1	
5	Visual Retailing	€ 4,000		1	Price for Mock Shop, per module per user, can go up to 10,000, for all 3 modules up to 18,000
6	Infor	€ 2,000		0	
7	Option Systems			0	
8	Pebblestone	€ 3,500		0	Based on 1 user, for a multi user package of 20 with basic function 65,000
9	Alva Products			0	
10	Blue Fox Ned Graphics			1	As to the needs of the customer
11	Koppermann (Tex-Data)	£5,000		1	Classic (Des) with 2 licenses £5000, PDM sliding scale Lite £1200-2200, Visual Merc £10000
12	GenCom			1	
13	Telmat Industrie (SYMCAD)	£35-80,000		1	Depends on configuration
14	Human Solutions GmbH	€ 70,000	€ 40,000	0	Depends on requirements
15	E-Measurement Solutions Ltd	£400		0	£400 per unit
16	Blackman & White			0	
17	Microsoft Germany GmbH			0	
	Sum Total:			**9**	
	Count			17	
	% of total			**53%**	

Appendix 10 - E3 P1 Retail sector data

1-4 Retail sector respondents

0: No mark
1: Indicated agreement

Section 1: IT Overview

	1a Technology services used						
	Design & Prod Dev	Retail	Sourcing, logistics & transport	IT	Mfr Tech	Accountancy Software	Innovative Tech
1	1	1	1	1	1	1	1
2	1	0	0	1	1	0	1
3	1	0	1	0	1	1	0
4	1	1	1	1	1	1	0
Sum Total	**4**	**2**	**3**	**3**	**4**	**3**	**2**
Count	4	4	4	4	4	4	4
% of count	100%	50%	75%	75%	100%	75%	50%

Section 1: IT Overview

	1b Suppliers of service							
	Design & Prod Dev	Retail	Sourcing, logistics & transport	IT	Mfr Tech	Accountancy Software	Innovative Tech	Comment
1								IBM set up a lot, but they have internal systems
2	Lectra, Gerber, Apple Mac	Unknown	Unknown	Unknown	Gerber	Unknown	Browzewear, Lectra, Gerber	
3	Lectra, Illustrator		SAP		Lectra	SAP		
4	Corel, Microsoft	Options, Microsoft	Midas, Apogee, Microsoft	Microsoft	Microsoft	Microsoft	Unknown	

0: No mark
1: Indicated agreement

Section 1: IT Overview

	1c Integrated?			1d Suppliers compatible?			1e Comments
	Yes	No	Some	Yes	No	Possibly	Additional comments
1	1	0	0	1	0	0	Suppliers only need compatability with accessing their order details
2	0	0	1	1	0	0	
3	0	0	1	0	0	1	
4	0	0	1	0	1	0	This company is too small to demand companies buy their software, same goes for sewing machines
Sum Total	**1**	**0**	**3**	**2**	**1**	**1**	
Count	4	4	4	4	4	4	
% of count	25%	0%	75%	50%	25%	25%	

0: No mark
1: Indicated agreement

Section 2: Business considerations

	2aTechnology identified				2b Inf. By competitors		
	Advertising	Trade fair	Reccomendation	Other	Yes	No	Unsure
1	1	1	1	Through their own internal systems	0	1	0
2	0	0	1	Research & Development	0	0	1
3	0	1	0		1	0	0
4	0	0	0		0	0	1
Sum Total	**1**	**2**	**2**		**1**	**1**	**2**
Count	4	4	4		4	4	4
% of count	25%	50%	50%		25%	25%	50%

0: No mark
1: Indicated agreement

Section 2: Business considerations

	2c Budget?		2d Consumer considered?			2e Comments
	Yes	No	Yes	No	Unsure	Additional comments
1	1	0	1	0	0	
2	1	0	1	0	0	
3	1	0	1	0	0	
4	1	0	0	0	1	
Sum Total	**4**	**0**	**3**	**0**	**1**	
Count	4	4	4	4	4	
% of count	100%	0%	75%	0%	25%	

0: No mark
1: Indicated agreement

Section 3: Relating to SizeUK

	3a Findings applied?			3b Blocks/fit altered		
	Yes	No	In the future	Yes	No	In the future
1	0	0	1	0	1	0
2	1	0	0	0	1	0
3	0	1	0	0	1	0
4	0	0	1	0	0	1
Sum Total	**1**	**1**	**2**	**0**	**3**	**1**
Count	4	4	4	4	4	4
% of count	25%	25%	50%	0%	75%	25%

0: No mark
1: Indicated agreement

Section 3: Relating to SizeUK

	3c Inf. Returns for fit?			3d Imp non-std gmt provision			
	Yes	No	Not yet proven	Yes	No	Unknown	Not yet proven
1	0	1	0	0	1	0	0
2	0	0	1	0	0	0	1
3	0	0	1	0	0	0	1
4	0	0	1	0	0	1	0
Sum Total	**0**	**1**	**3**	**0**	**1**	**1**	**2**
Count	4	4	4	4	4	4	4
% of count	0%	25%	75%	0%	25%	25%	50%

0: No mark
1: Indicated agreement

Section 3: Relating to SizeUK

	3e Been worthwhile?			3f
	Yes	No	Not yet proven	Additional comments
1	0	0	1	As stated above, more data and increased number of people measured would be required
2	1	0	0	
3	0	0	1	
4	0	0	1	No petite or outsized is included, there is no interest, but no action taken. Sizes are due to be altered, consumer likes the fit so only minor changes will be made
Sum Total	**1**	**0**	**3**	
Count	4	4	4	
% of count	25%	0%	75%	

Appendix 11 – E3 P2 Semi-structured interview responses

Terminology and Abbreviation list:

Fabric Technologist - FaT

Fit Technology (or Technologist) - FiT

Garment Technology (or Technologist) – GT

Pattern Cutter - PC

Introduction

I am interested in gaining an overview of your work roll length of time in your current position;

- Has been with this business for 22 years, needed broad based experience prior to joining, originally a PC and grader
- Has been with company for 5 and a half years, started as a Technologist, now a Senior Technologist. Prior to industry she worked in industry for 15 years, starting on the manufacturing side
- Worked for this company for 3 years, worked on a consultancy basis for 9 years prior in Hong Kong which gave an insight into the processes, practices and procedures they used
- 10 months, first job after graduating from Herriott Whatt
- In current role for 5 years, been at the company for 11 years. Background is Textile Technology, headed up fabric/colour team before becoming QA Manager. Now oversees cut/make/fabric

where your position is placed within the organizational hierarchy

- As FiT, he is in charge of a five person team, including members who can use the Gerber and Lectra systems.
- Has 7 technologists below her, covering Clothing, Accessories and Home wares. The management hierarchy above her; Brand Director, 2 x Buying Directors, Merchandising Director, Merchandising Manager, Buyers (Assistant to Senior), Merchandisers (Assistant to Senior), then Technology works alongside
- This lady drew a process diagram (show electronically). We agreed that similar roles had different titles

- Three main departments, Technical, Development and Design. In technology they oversee production through the factory, QC follow up, warehouse audits and monitoring of returns
- Buying, merchandising, technology all work together as a unit supported by design

explain the interrelationships that exist between different departments, how many internal departments are involved in the development of a garment/range?

- Buying, Design, Technical and External suppliers
- Again, illustrated by the diagram. Their Product Manager oversees product licences, compiling feedback, product preferences by country (very important for their business).

What is your awareness of changes in garment technology processes and practices? Outline practical knowledge you have of other industrial roles?

- Working to the 'fast fashion' theory, they want to retain standards, combined with speed, means many risks are being taken
- They have an interest in developmental technology as they are in the field of high performance sportswear

b) At what stage does product handover from the garment technology department occur? At that stage, who then becomes responsible for the product?

- Buyer is always responsible for the product, any fit issues are the responsibility of the GT, major issues, then the FiT is involved. FaT can also be involved
- Once the garment is sealed it is handed over to the supplier in the factory, then it becomes the responsibility of the supplier to manage the system
- The term they use is 'cross functionality', once range review is completed by the Designers, they pass it on to the Technologists, who complete the product specification, it then goes to the Product Manager, then it goes back to the Designer to confirm what they are going to be making is what has been designed
- Stays with the team right through the lifecycle, right through to the RTM's. They pride themselves on their quality
- Buy across the five internal brands (outlined in notes). Designer, technologist and buyer work together until the garment is sealed, standard is agreed with the supplier prior to production, they make pre-production samples and agree to make to that standard. Most of the manufacturing takes place in the Far East, other places are Europe, Asia, UK. They have offshore offices in Hong Kong, Bangladesh, Thailand, Shanghi, Delhi, Tirapor all working closely with the suppliers doing QC checks and inspections.

Additional Questions that emerged from the first two interviews:

Do suppliers have design teams and technologists that you work with?

- Comprehensive outlines of styles, or 'stories' are generated 18 months before the season, which are farmed out to suppliers
- Depends on the manufacturer, if the contract is directly with the factory, then there is no GT, but they generally have merchandisers working alongside
- Technologists through sourcing, some just takes place by the merchandisers
- Depends, indirect suppliers have more, in China it is less likely

Is there a difference between Garment Technology and Fit Technology?

- GT is responsible for garment make-up
- No, within the team of 7, two used to be PC, and their workload is prioritised depending on the source of the manufacturing. They find it hard to find GT within their specialist field
- No difference
- No

Ask about the supply of technologists to the industry.

- Constant pressure within industry not allowing the trainers to train new technologists. Most graduates want to design. Senior technologists are generally based in the UK, with a team offshore. GT has incorporated Pattern Technology
- Many graduates don't realise the diversity of the roles that they could go into, very diverse. Lecturers seem to becoming more aware
- There is a void in terms of provision, seems to be a lack of technology courses
- Within the team of technologists they have graduates from Herriott Whatt and Nottingham Trent, both are good. The general standard does not seem as it used to be, expectations of the graduates often hyped by the university both in terms of finance and the role
- There are still good people around, in 10 years there could be an issue. Not many college leavers being taken on as the work is at such a fast pace, not enough time to change. Aim to retain staff and recruit people with experience. It is an aggressive environment

Additional comments considered relevant:

- Knowledge gained through industry was fundamental, it is great to be able to understand both sides, helps to understand development and production sides
- Further up the management levels you go, the less contact you have with the product

- Products are distributed to 180 different countries, there is a whole array of preferences across the world, UK prefers dark, Italy prefers orange, reds and pinks
- Within their business there is a new buzz-word 'cross functional working' which is similar to multitasking or multi-skilled, incorporates marketing and branding into the development process
- They work in small teams, in limited space, very interrelated functions, close at hand to make communication easier
- Part of this ladies role is to identify new technologies, either software based or new physical manufacturing technologies such as sewing/bonding
- As a business they have many customer segments, difficult to identify what they all require, many different brands and customer sets
- Have not really taken on graduates for about 6 years, part of their training is to work alongside the technologists, involves going overseas
- Many additional comments relating to this market sector

Section 1: IT overview

a) You identified that your company uses [technologies outlined], could you talk me through the processes used on each system.

Lectra – pattern cutting and grading

Gerber (Version 8) – Ideally would like people to be trained to use this system, but they are hard to find

Browzewear – Design tool (similar to Optitex) that can allow garments to be applied to a virtual avatar, helps with planning patterns (placing of pockets etc).

- This company runs a bespoke system supplied by IBM, it is a DOS based system that is internet based, it covers orders, deliveries, payment details, allowing the retailer to monitor progress of all the orders, there is limited capacity to view images. Connects stores to the head office also (like an EPOS system). They do have access to Gerber for 'pattern repair'
- Lectra – they use this to generate patterns, however this is not generally used in the Far East, so patterns have to be converted so they are Gerber compatible.

Illustrator - for Design, CAD that holds the image, then uploaded into Powerpoint

SAP – company wide system for controlling orders and deliveries (like a PDM)

- Corel – Design

  Options – Mail order

  Midas – Stock control

  Apogee – Ordering/stock control

  Microsoft – Everything else

- Gerber

  Web PDM – for product approval (all elements), success depends on willingness of the suppliers to be involved

b) To what extent do you use technology within your role? Are new employees required to have working knowledge of your systems?

- More for administration, uses Gerber 2 or 3 times a week
- Uses the IBM system every day, to update and check progress
- PC skills required, Word, Excel and PowerPoint as a minimum. Being trained on Lectra would be a bonus
- Not really as relevant, would hope that new employees would have good working knowledge of Excel and Word as they are used on a daily basis
- Preferable, but it is easy to pick up. Her team uses it mainly, she just runs off progress reports

c) What is your personal experience of industry specific technology use?

- Completed 2 day Gerber training, then self taught
- Probably more relevant to design, CAD based. There are 21 designers in this business, GT work with them at an early stage creating the 'design packs'. Everyone works to blocks, unless it is something totally different/new. There are two internal fit models, both size 10.
- As a company they would be way behind if they did not adapt to new technologies. Their parent company invests heavily in new technologies
- Only really used it at university
- Has used it in the past, not other that Classic/web PDM

d) Could you discuss any negative aspects of IT use

- Definitely has its place, however users must understand garment construction and grading rules
- It is needed, she felt that in some cases it stifles creativity
- The internet based system they use 'seefolders' (?) you have to rely on people to keep it up to date, but it is not too bad
- People tend to be dealt with via email as it is easier to get a response
- Speed, everything is so fast, sometime the IT is not quick enough, often email is quicker. Capacity is also an issue, they are considering moving to a browser based

system. In addition, if suppliers do not have the capacity on their mainframes India/Thailand struggle the most. She mentioned how development of industry specific technologies is much slower than consumable technologies, and as an industry you have to work with what is available

e) Which industry specific technologies currently used would you consider to be successful and unsuccessful

- Gerber is very successful, Optitex – the Jury's out (?). In terms of mockshops, this company prefers the real thing
- They do not produce any patterns, the suppliers do that, as they do them their own way

f) Has the use of new technologies removed the need of practically skilled and knowledgeable clothing people?

- Technology does not solve everything, need a broad based knowledge to make it work
- No, you need the people, they compliment it, it is an addition
- No
- It may have for the industry, but not so much for this business
- Definitely not

Additional comments considered relevant:

- Preferential for Gerber users to have been a pattern cutter prior to using Gerber.

Within their business they have recently re-opened a sample room with machinists after not having one for 7 years

They do not run a PDM system as such, their contracts are managed via their Contract Management System (CMS) which has similar principles in terms of recording product details, labels, sizing

- They have 35 working in their head office, and they have 30 stores (that would class them as SME?) The person I spoke to did not think that they would be entitled to any government money as they are privately owned
- Shorter lead times for garments made in the EU

The majority of problems they have with products is through the goods sold from branded suppliers

Section 2: Business considerations

a) To what extent are you involved in generation of industry specific technology budget process? If so, can you explain how budgets set for technology spend?

- They stay aware of new technologies, if they did find something they considered to be relevant, a business case would be generated as part of a formal process
- The updates are limited and minimal, as a business they don't get too involved, as the system is used group wide
- Strongly involved. She has an annual budget, gave an example of a specialist printer that is being considered for purchase in the future
- Not really relevant

b) In the questionnaire I asked if the consumer is considered when sourcing technology, could you expand on this.

- Consumers are always considered, all things to all people
- Links to the Product Manager role, considering the feedback they compile from all the suppliers
- Not relevant, mainly due to budgets

c) Does use of technology affect working relationships between departments?

- Does not consider it to make a difference
- Technology helps, especially with communication around the world, anything that clarifies and speeds things up is good, even the fax
- There has been a recent influx of designers, but GT has stayed the same, this makes communication difficult with the increased workload
- Yes, web PDM is an interactive tool, buyers and technologists have to input, buyers set up the packages, style codes, packaging information, technologists work with the fit comments, so yes, it is used across functions

d) To what extent do users of technology influence the procurement of more advanced facilities?

- They always listen to suggestions
- Yes, they would listen to recommendations from new staff, they like to consider all avenues
- One of the new designers brought Corel in, aiding the design side, has made an improvement to the samples coming back, as it is possible to add more details to the sketches. Photos are also sent digitally using Word.
- Due to the (recent) merger of the businesses the standardisation of use has been set, does not mean that it is the best tool on the market, once it has stabilised, then the review of other options will begin

Additional Questions that emerged from the first two interviews:

Do suppliers suggest technologies?

- Yes they have been known to
- One supplier has a video link
- That does not happen

What is your main target customer?

- They have four main customer segments; Performance (elite), Sports (Sporting use), Wellbeing (older more discerning customer), Fashion (trend driven)
- They don't know! Different people would give you different answers, probably AB demographic because of price and location of shops. Most consumers would not know the benefits until they wore the garments, function
-They have many

Additional comments considered relevant:

- During this businesses transition phase, development took a back seat, now it is back on its feet, they want to continue to invest, as they are generally copied by many other retailers

Section 3: Relating to SizeUK

a) Even though SizeUK was compiled on a demographically representative basis of the population in 2001, do you think the data is relevant to your companies' target market sectors?

- Yes, definitely, it reaffirmed the findings made by their organisation, he is still involved in bi-monthly meetings with SizeUK
- Yes, data can be chunked as to what you need
- Interesting, but their consumers shop with them as they like their fit, so it is relevant to a degree. They do use the data to an extent. There will be a benefit, allows you to look at ratios etc
- Yes, they do use the database, they have pulled information off, she did not work on the project. The data is not just used on a standalone basis, it is used in conjunction with other information and technologies

b) Realistically, do you think the SizeUK data is going to be used in a significant way within our company?

- Will always be referred back to
- They are unable to get the one measurement most relevant to them (body loop), Bodymetrics are developing some software that may allow this to be calculated
- Not in a hugely significant way, may tweak, but they work from their fit models

- Yes

c) In the questionnaire you said that involvement in SizeUK had been worthwhile for [your business], could you expand on this.

- Have had no uptake with the website, she felt that you have to know how to deal with such a large mass of figures

d) What factors influence change in sizes of the fit model?

- Feedback from store, also it is trend driven, dependent on style. Samples always fitted to a 10, blocks have changed only slightly
- As a business they are aware of the adaptations made by major high street retailers, such as the average woman has a larger waist. Also they rely on customer feedback
- Relates in most part to the customer feedback, this is very thorough, which is combined with other data

e) What is your personal experience of body scanning and SizeUK data technologies

- Uses the website occasionally
- Not been scanned, has used the data
- Not been scanned
- Something that had been involved in at university, she does have her questions
- Was not involved, did attend a number of presentations

f) Could you explain how important fit is considered within your company.

- Very important, consumers want a garment that they can wear more than once, also fit needs to be consistent
- Fit is paramount
- It is vital, consumers like the fit and the comfort, so maintaining fit is key
- 50% of their returns are for fit related reasons, so it is a constant issue, constant fine tuning and modifications. From the returns they identify if there are any trends 'too big', or 'too small', if it is evenly weighted, it suggests that it fits people, if it is skewed either way they would investigate further

g) Has involvement in the SizeUK study encouraged involvement in any other developmental research projects?

- Has been speaking to Bodymetrics about the development of a generic model for all the SizeUK partners
- As they are fashion driven, they want to be involved in new things, it could be the 'thing' that makes a difference. As nothing new has come along, they have not been involved

- Yes, they have had contact with Bodymetrics as they are launching an 'Asian Fit' for China and India. Due to religion they have different requirements, breast padding to stop nipples showing, lower leg height
- No
- Not on a national scale, internally they look at competitors fit, how their own fit is in relation to others

Additional Questions that emerged from the first two interviews:

Are you aware of any further developments occurring within SizeUK?
- Yes, development of a national average
- Yes
- No

Do you think that a survey of this size will happen again?
- Needs to, should be every 5-10 years as the information will be out of date soon. Most of their product ranges are based on the European body shape, they do not really think about the other populations

Additional comments considered relevant:

- This business are considering going down the mass customisation route, with the increased availability of single ply cutting
- Walmart customise their product ranges by demographics eg. Asian communities
- Consumers will often buy multiple items if they know a garment fits
- Often consumers are after colour and style, and will put up with poor fit if they can get the look they want
- The business is doing well as it has diversified, still uses core suppliers (different geographical production), smaller more innovative suppliers compliment core ranges/products
- Products are changing every few weeks
- Time is a restrictor, projects like SizeUK are very time consuming
- Study has identified that two people are rarely the same
- The industry has changed, in the past it was more designer driven
- It used to be very skilled, but once technology has come along, much of that has gone.
- If you are a creative person, (in relation to Fashion Degrees) graduates are less likely to be interested in technology, that is how people are lost

- They were hoping that the body scanning technology would enable them to have a 'dummy' made to the size of their fit model, she has been scanned, but the cost to make it was too much
- Using the historical data (from returns) they have compiled gives them an advantage, as on the whole that type of data is lost on the high street
- Likes that fact that there is an close link between the roles, as being able to work together harmonises quality, performance, technical manual and sizing

Appendix 12 – E1 P2 Round robin results

Each section below gives the comments that were compiled during the round robin element of the sector specific focus group sessions.

Design

C1 Potential gains to be made through the use of technology within the clothing industry MSME's are...

DD

Improve communication

Streamline administrative side of company

Use of illustration/design software (photoshop etc) to improve accuracy of specification drawings

DC

Agree with comments above

Improve lead times, getting design work into factories quicker

Improve accountability and traceability, notes made of dates (ET?) on patterns

Lack of human error – checkability

Easily reproducible

DB

Multi-tasking: technology can be producing whilst the designer is creating

Involvement of larger companies influence

Agree with all of above – ease of use

DA

Work can be stored and recoded digitally

Work/design can be instantly sent worldly from design house to overseas manufacturer

C2 Other than outlay costs, the factors influencing an organisations decision to invest in technology would be...

DC

Whether equipment can be leased, whether skills to use the equipment is already held, whether expertise can be acquired easily

Whether it is cost effective – will it be fully utilised?

Whether it is cheaper to outsource?

DB

Time factor – is it time efficient including learning time to be able to utilise the technology

Length of time this technology can be used – still be productive

Will this put them ahead of the market?

DA

Will maintenance of this equipment be expensive? I agree with the question whether it is cheaper to outsource?

Do other comparative organisations use this technology? How popular is it?

DD

Does it provide more predictable/better results in whatever area it is utilised?

Does it make someones job easier?

Does it save someone time?

C3 The most annoying thing about high street clothing fit is…

DB

Poor quality/sameyness/copycat – mass production is leading to the real evidence of the design being lost in translation.

DA

Mass production is badly made, but some retailers do get fashion direction and the 'throw away fashion' concept correct

Sizing can be off ie a size 12 can have a 2 inch discrepancy which is acceptable

Fabric is cheap and washes poorly

DD

It is repetitive – everyone is wearing similar looks

Cheap fabrics

Hardly any large sizes available (I'm told)

DC

The price! How can MSME's compete when peoples price expectations are so sensitive to price

Throw away clothing, not environmentally friendly

People can not identify quality

C4 The area of clothing industry MSME businesses that would benefit most from the use of industry specific technology is…

DA

Testing of fabric/washing tests, dry cleaning instructions, quality control.

Pattern cutting/grading of basic blocks key pieces

Upgrading of block size to all sizes

DD

Grading to sizes over different garment types – very useful

Manufacturing

Distribution/marketing

DC

Administrative tasks – keeping specifications/manufacturing information updated

Design work – more relevant than manufacture?

DB

Industry specific technology could benefit communication ie same language as larger companies and out sources

Designer can design and create whilst technology also does work

C5 If there was a market for batch produced clothing goods in the UK how realistic would implementation be…

Not used in this session

Manufacture

C1 Potential gains to be made through the use of technology within the clothing industry MSME's are…

Keep us up to date, competitive

Improve methods of every aspect of business

Potential to keep up to date in business

Design & production

Keeping up with the market

Better efficiency, cost effectiveness, increased margin intake.

More efficient working practices, which would lead to reduced costs.

Communication – via email and shared data/shared technical (spec) files

Controlling data, tracking designs, tracking production

Analysis – targets, KPI's, efficiencies

C2 Other than outlay costs, the factors influencing an organisations decision to invest in technology would be…

Ongoing employee development

Expert advice in the market

Disruption period over introduction & training requiring extra personnel to keep existing work going. We run at just enough personnel!
Adequate 'work place' help in getting it up and running to reap the benefit and ensure use of 'technology' to its maximum benefit.
Choosing current technology appropriate to size and requirement – time to do this again and again – appropriate people to do this
Knowledge that technology will help, but identifying which would benefit most

To improve product specification, reduce errors, maximise efficiency, reduce time spent on tasks – reduce costs

C3 The most annoying thing about high street clothing fit is...

The rate of change [seconded]

Cheap prices – I cannot buy cloth for finished garment price, Tesco denims for children at £2.50

Poor quality and poor finish, cheaper fabrics
Attitude that garments should be disposable, wear once and discard
Quality design or slavishly following catwalk trends

Keeping up with the big boys like Tesco etc. unable to compete on price
Small independents are being pushed out of business
The fact that it is predominantly made abroad

C4 The area of clothing industry MSME businesses that would benefit most from the use of industry specific technology is...

Manufacturing and retail

Big businesses that ___ in large quantities that helps keep costs down

More consistency to specification if dealing in continuous product
Data management system
Communication flow

Manufacturing from design through to retail [all areas]

C5 If there was a market for batch produced clothing goods in the UK how realistic would implementation be…

There is definitely a market for batch produced garments, and we find that the smaller the batch the higher the price and ultimately the better profit margin
The set up costs for batch production are similar to bulk production, therefore the margins need to reflect this

Limited to company size (manufacture)
Depending on batch size, could be readily achievable

Not realistic! Big boys would just buy exclusivity
We produce from 1 garment to 10 garments to 100 garments in the UK
Offshore for 500+
There is a market and we are in it
Result margins smaller and smaller
Minimum wage in 2006 + 6%
Energy +10%
Insurance + ?%
But price increase -10%

Market

C1 Potential gains to be made through the use of technology within the clothing industry MSME's are…

MAD
Efficient manufacturing
Access to wider market
Design capability
MAA
Less wastage
Reduced costs or better efficiency
Improved communication of data (facts) plus ease of sharing information, and reference to historical data
Being able to relate to the competition within the market place
MAB

Ability to enter niche markets with higher profit potential

C2 Other than outlay costs, the factors influencing an organisations decision to invest in technology would be...

MAA

Training involved – Who? How? When?

Timescale involved in implementation

Fear factor – has the technology been tested successfully for the process required

MAD

Capability/capacity of staff to use

Lifespan of technology – how quickly does it become out of date

MAB

Management time required to assess options

MAC

Return on investment timescales/cost benefit analysis

Location of equipment/planning

Reliability of equipment/repair insurance and costs

C3 The most annoying thing about high street clothing fit is...

MAC

Cheap and nasty in some instances

Unreliable quality

Very much aimed at the young market (casual not smart)

Poor in design

MAB

Poor quality resulting from focus on low price points

MAD

Size variations (American, European sizes etc)

MAA

Volume, running the risk of wearing the same as friends/family/community etc

Lack of individuality

C4 The area of clothing industry MSME businesses that would benefit most from the use of industry specific technology is...

MAB

Technical/sports clothing

MAC

Bespoke menswear

Outdoor garment

Specialist wear (sports or industrial)

Ladieswear in delicate materials

MAA

Retailers in general if sales improve because of customer confidence in garment fit, wear etc

Small manufacturing runs (limited quantities) of styles where efficiency of cloth and labour is essential

C5 If there was a market for batch produced clothing goods in the UK how realistic would implementation be...

Not used within this group

Appendix 13 – E1 P2 Focus group transcript excerpts

This portion of the appendices has been included to incorporate an excerpt from each of the three focus group sessions, rather than include the very lengthy full transcripts, which would be available electronically by request.

Design

Fashion Sector focus group, held in the CfDR meeting room, Wednesday 4th Oct 2006	
Interviewer:	Clare Hussey
Attending:	DA Emma, DB Amy, DC Victoria, DD Gael

This group consists of four group members, two industry based, two academic staff who have recently left the industry, therefore there is a combination of experiences and backgrounds. The content of this session has been devised as appropriate method of data collection relative to the clothing industry, and had been amended though conducting a pilot session.

Duration: 85.49 minutes

Transcription Key

A indicates speaker

A?/B? indicates not sure of which speaker, but only one

C/D means both at the same time

... at the end of a line means the next person started talking overtop the first speaker/or interjected a comment

... in middle of speaking indicates a speakers brief space between spoken words

[pause] indicates a speaker's space longer than a brief space of a ...

[laugh] a short burst, usually self conscious, from the speaker

[laughter] general laughter from the group

[explanatory text] to indicate what is happening during the session

[general settling noises, and explanation of the housekeeping requirements]

Int

Around this table we have fashion design people, or people that work in fashion design or affiliated areas, it is a group that has been formulated to discuss the findings that I have obtained through my research to date. I have a basic terminology list that explains some of the terms that may be used within this group session [sheets are handed out]. If I can just draw your attention to the section at the bottom, this outlines the industry sectors that I have identified. When I first started my research I identified that there was three main sectors within the clothing industry as it stands, the design, manufacture and the market sectors. So throughout my

research, I have been using these three areas as areas of focus. This session is the first of the three sector to be run, with the manufacture and market to be conducted next week. What I am hoping to do within this session is to apply the knowledge that you have to the points we are to be discussing, and hopefully it is going to be fairly enjoyable! To begin the session I have compiled a selection of statements, which have been put onto separate sheets to be used as a 'round robin' exercise [sheets are handed out]. What I would like you to do is spend a couple of minutes on each statement, to see if you are able to devise an answer or a comment.

DD
What did MSME stand for again?

Int
It stands for micro, small and medium sized enterprises [rustling of paper]. I will give you a couple of minutes to do these, but if you finish sooner feel free to pass it on to anyone else who has finished. Feel free to ask any questions.

DA
Is my 'industry specific technologies', is that machinery and things like that?

Int
Yes, it could be machinery, or it could be pattern grading technology, or that type of thing. [allocated time elapsed] That is almost two minutes if you would like to finish off and pass your comments sheets on [sheets passed around].

DD
Should we be putting different comments onto each?

Int
If you agree with any comments made then state your agreement. [allocated time elapsed] Right, that is coming up to two minutes again.

DD
I don't quite understand this question, 'the area of clothing industry MSME businesses...' What do you mean by the area?

Int
This could be manufacturers, or maybe businesses that specialise in design, say a design consultant, or it could be... really it is different types of business, which area...

DD
So it is not the things that you would use the technology for so much, it is what parts of the business. I probably haven't answered this one correctly then. I had read the comment above and just carried on from there, maybe that is not what it is asking for.

Int
I suppose it is the case that each person understands the statements in a different way.

DD
Do you just want us to move on then?

Int
Yes, when you are ready. I am just trying to control the time as when I ran the pilot, I just let everyone have a free reign [laughter]. [allocated time elapsed] Right, I think it is about time we passed them on. [allocated time elapsed] OK, so I think that is about time to finish. What I would like you all to do at this stage is as each of you have made a comment to each statement, I would like you to read through the comments on the sheet you have identify from anything that has emerged that is key, maybe we can have a discussion about it.

DD
So read through the sheets we have here.

Manufacture

Manufacture Sector focus group, held in line with a Skillfast-UK Regional employers meeting at the Access Training Centre, Team Valley, Thursday 12th Oct 2006
Interviewer: Clare Hussey
Attending: MFA Tom S, MFB Brian, MFC Dave, MFD Lynn, MFE Lucy, MFF Tom

This group consists of four group members, four industry based, two industry related training representatives, therefore there is a combination of experiences and backgrounds. The content of this session has been devised as appropriate method of data collection relative to the clothing industry, and had been amended though conducting a pilot session. Prior to the session I made a short presentation outlining the basis of my research programme, and the importance of the opinions of industry sector input.

Duration: 69.28 minutes

Transcription Key

A indicates speaker

A?/B? indicates not sure of which speaker, but only one

C/D means both at the same time
... at the end of a line means the next person started talking overtop the first speaker/or interjected a comment
... in middle of speaking indicates a speakers brief space between spoken words
[pause] indicates a speaker's space longer than a brief space of a ...
[laugh] a short burst, usually self conscious, from the speaker
[laughter] general laughter from the group
[explanatory text] to indicate what is happening during the session

[general settling noises, returning of the consent forms, introductions around the table]

Int
What I am trying to do within this focus group is to attempt to gain some sort of consensus with the findings I have gained in the initial stage of my research. In order to start everyone off nice and gently, and bear in mind that I did not really know how many people were coming, I have printed off five sheets, all with a sentence at the top, I would like you to read it through then make a comment, then pass it round.

Mff
So they are all going to go around.

Int
Yes, once you have done, pass it on. Feel free to ask questions, they have been devised to be relatively challenging in order to get your brains going. If I give you two minutes per sheet.

Mfd
Can you explain the term MSME.

Int
Micro, to Small and Medium sized enterprises.

Mfd
Wow, that's a new one!

Mff
So that is all businesses up to 250 employees.

Int
Yes, that's it. I was just using the term SME, but a lot of the clothing industry sector businesses fall into the Micro sector.

Mfe
So what differentiates micro to small, just for interest.

Int
Number of staff.

Mff
Micro is 1-10, Small is 10-50, 50-250 is medium, it is just one of those European...

Int
I do have this outlined on a terminology list, which I should have handed out, as some of the terms are familiar, others are not.

Mfe
So why did I get hooked up on 20 being the important number [for employees]

Mfd
To do with employment legislation [inaudible], relating to pensions [inaudible]...

Mfe
Thank you.

Mfb
How do you want us to answer this, as a supplier or as a customer.

Int
From the point of view of a small business.

Mfd
Can you define what you mean by 'batch produced'.

Int
By batch, rather than doing a large scale production run, where you produce say 1000 garments. If you were to run off say 100 garments, that are more specific. Basically, not as high quantities as that would be produced by a large scale manufacturer.

Mfd
There is a market for batch produced clothing, so where you say 'if there was a market for batch production...' there definitely is! And that will continue with the reduction in seasons, where as now there are seven or eight seasons in the year, but models that are used by the likes of Primark and Matalan, where they constantly

refresh their ranges every two weeks, with new goods coming in. So there is definitely a market for that.

Mfc
I think that we find the more expensive the garment, the less bulk production we would...

Int
So, the more expensive, the less production.

Mfe
We find that we are having to change. There was a time when we just made navy and black, and we could churn out navy and black very nicely, as it is niche market and protective. Now though, we are finding that we are having to follow fashion much, much more. Our biggest seller at the moment is bright pink [product description] in child sizes XXS-XL. But that is in children's sizes only. They are not made in vast quantities, but they are [inaudible] moving short time.

Mfd
Is there a decent margin on it, even though you have had to change your production?

Mfe
The margin is never as good [inaudible]

Market

Market Sector focus group, held in line with a Skillfast-UK Regional employers meeting at the Access Training Centre, Team Valley, Thursday 12th Oct 2006
Interviewer: Clare Hussey
Attending: MAA Claire, MAB Alan, MAC Fred, MAD Malcolm

This group consists of four group members, two industry based one sector skills council and a training agency representative, therefore there is a combination of experiences and backgrounds. The content of this session has been devised as appropriate method of data collection relative to the clothing industry, and had been amended though conducting a pilot session. Prior to the session I made a short presentation outlining the basis of my research programme, and the importance of the opinions of industry sector input. As this session was run second, it did not start until after 7pm, resulting in one of the group members having to leave before the end.
Duration: 60.54 minutes
Transcription Key
A indicates speaker

A?/B? indicates not sure of which speaker, but only one
C/D means both at the same time
... at the end of a line means the next person started talking overtop the first speaker/or interjected a comment
... in middle of speaking indicates a speakers brief space between spoken words
[pause] indicates a speaker's space longer than a brief space of a ...
[laugh] a short burst, usually self conscious, from the speaker
[laughter] general laughter from the group
[explanatory text] to indicate what is happening during the session

[general settling noises]

Int
[explanation about completing the consent form] This focus group has been devised in order to discuss the findings of the first phase of my research. I would like to start off [Helena asked for names, so introductions were made], I am just going to pass around some statements, could you have a quick look, then make a comment on the sheet. I will give you a couple of minutes, or when you are finished, you could pass them on.

Mab
Before we start, can I just ask what MSME stands for?

Int
Micro, Small to Medium sized Enterprises. I do have a terminology list, but I was in a bit of a rush [hand out terminology lists].

Mac
Do we all have different questions?

Int
Yes, all the statements are different. Feel free to ask any questions. [noises as exercise is being completed]

Mab
I must have had a much easier question, I have only written a tiny bit.

Int
If anyone else is finished, then you can swap over. [noises as exercise is being completed]

Mab
There is one more to do on this sheet, but as I don't know everyone's writing, I don't know who it is.

Int
If there are any that you don't feel that you can add to, you don't have to. [each of the group members managed their time themselves, passed on the sheets when they were completed] Whilst everyone is finishing off, if I just explain what I am wanting now. If you have a quick read through the points noted down, identify a key point that you would like to talk about. From your sheet think about what is most pertinent. So, would someone like to start, so we can have a quick chat about them.

Mac
I have C3, obviously, this is an every day occurrence to be fair, in many companies at some stage will consider this. Other than the outlay costs, I suppose the obvious one is who within my company will be able to use this equipment, do they need training, how will I cover that person, how will I maximise the benefit of the machinery/programs. It boils down to a cost benefit analysis at the end of the day. It will come down to cost at the end of the day, even if the initial outlay is very small, there will be a stage where the company needs to access will it bring the bottom line profit using that equipment, would it make it quicker or more efficient. Again, I think it is very much around the training and implementation of the equipment, that is quite important.

Appendix 14 - Follow up (Critical incident) questionnaire

At what moment/s during the FG session did you feel that you were most engaged with what was happening?

- From the beginning and throughout
- The open discussions were really engaging and I felt as though we were bouncing thoughts off each other as it was a small group it became more personal
- At all times, the topics were relevant to my understanding on industry and commercial practices. The session was wholly interactive, with appropriate prompts and exercises

At what moment/s during the session did you feel most distanced from what was happening?

- Never at any time
- When we sat in silence and were asked to write answers to the questions provided written words can be interpreted in many different ways and so I felt unconfident of my answers and more isolated than interactive
- None

Was there anything that you observed, heard or experienced during the session that you found affirmed your views or helped your professional engagement?

- The similarity of views was re-assuring
- We seemed to have similar views on the fashion industry and how retailers present fashion – this was interesting as others backed up my thoughts with facts and their opinions. It inspired me to put more flair into the designs and not follow trend predictions so closely
- The industry has changed, but most organisations represented in the FG's were moving in a similar direction and the flow of communication and interrelationships across the company and the sector remain the same

What have you seen, heard or experienced during the session that found puzzling or confusing?

- Nothing particularly
- I found I had little knowledge of how fashion design is conducted in other companies as I am not from a fashion design background although currently linked

with this field, so I listened and took in all the information I could at the session then I researched further into this area. I feel this will benefit the way I work and may inspire new ways of working for me

- Nothing

Within the session what did you find most surprising or provocative?

- It was surprising how simplistic some people find their business processes
- Everyone's passion for their line of work – it really promoted emotive discussion. Also the requirement for creativity in the high street
- That organisations still 'stitch' (manufacture) in the UK

If you were to tell an industry colleague or associate about the FG session, how would you describe it?

- In interesting opportunity to compare views on priority business aspects
- A learning curve / a passionate forum discussing fashion design and manufacturing
- Well facilitated – good prompts and preparation. Useful forum to re-affirm thoughts. Useful forum to share good practice.

Arranging FG's designed to gain an industry insight was seen as problematic, how would you propose future sessions be arranged more effectively?

- You are welcome to share our "project steering groups" at any time – less meetings etc
- I thought the FG I attended was well organised with props and everything! The only worry was if more people were required for the session then I would suggest more advanced notice of the sessions so busier people can arrange around it. If you were able to set up a focus group at a work place it may be more intriguing for people to attend. Curiosity is a good seller!
- Breakfast seminars 8-9am via Chamber of Commerce or designated industry bodies like BCIA (for clothing)

Appendix 15 – Company profiles

Where possible the information within the company profile section of the following tables was obtained first hand from company representatives. If this was not possible, alternative sources were, such as from Skillfast-UK was used. (The logos are presented in colour)

Regional MSME businesses

1. Company name	Airowear Ltd http://www.airowear.co.uk		
Company size	Small	**Location**	Northumberland
Main products	Equestrian body protection, Rugby body protection, Seenin protective wear		
Principle product stage	**Design**	**Manufacture**	**Market**
Respondent role	Designer		Owner
Stage in research	**Element 1**	Element 2	Element 3
Company profile Airowear Ltd is a regional based business that sells internationally, with 25 employees and a turnover of £1.9 million. The principle product is equestrian safety wear which they design, manufacture and market their own branded ranges. Designs are generated in-house with limited manufacturing occurring onsite, the majority of products are produced offshore.			

2. Company name	Allcord http://www.allcord.co.uk		
Company size		**Location**	Newcastle
Main products	Outdoor wear retail		
Principle product stage	Design	Manufacture	Market
Respondent role			Owner
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

3. Company name	B Supplied		
Company size	Micro	**Location**	Sunderland
Main products	Training services for the clothing sector		
Principle product stage	Design	Manufacture	Market
Respondent role			
Stage in research	**Element 1**	Element 2	Element 3
Company profile B Supplied is a regional business, with 3 employees. The principle function is business development, training, mentoring for businesses within the sector and is primarily involved in the manufacture and market stages of the product lifecycle.			

4. Company name	Barbour http://www.barbour.com		Barbour
Company size		**Location**	South Shields
Main products	Specialist outdoor wear		
Principle product stage	Design	Manufacture	Market
Respondent role		Product Development Manager, Production Manager	Marketing Manager
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

5. Company name	Berghaus http://www.berghaus.com		berghaus TRUST IS EARNED
Company size		**Location**	Sunderland
Main products	Performance outdoor wear		
Principle product stage	Design	Manufacture	Market
Respondent role	Fashion Designer		
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

6. Company name	Cameron-Addison http://www.cameron-addison.co.uk		CAMERON-ADDISON
Company size		**Location**	Sunderland
Main products	Ladieswear		
Principle product stage	Design	Manufacture	Market
Respondent role	Owner		
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

7. Company name	Crampton		(no logo available)
Company size	Small	**Location**	County Durham
Main products	Replica sports shirts		
Principle product stage	**Design**	**Manufacture**	**Market**
Respondent role	Designer	Quality Manager	Development Manager, Financial Director
Stage in research	**Element 1**	Element 2	Element 3
Company profile (This company went into liquidation during early 2007, permission was given by the previous owner to show the details as the business was at the time they were involved in the study.) Crampton was a regionally based business, with approximately 15 employees. The principle product was replica sports shirts meaning that we are primarily involved in the design and market stage of the product lifecycle, however they also kept abreast of the offshore manufacturing quality of the goods they produced.			

8. Company name	DCC (Dewhirst Corporate Clothing) http://www.dccdirect.co.uk		DCC DIRECT
Company size		**Location**	
Main products			
Principle product stage	Design	Manufacture	Market
Respondent role		HR Manager	
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

9. Company name	Impressions Retail		impressions RETAIL OUTLET
Company size		**Location**	Peterlee
Main products			
Principle product stage	Design	Manufacture	Market
Respondent role			Merchandising Director
Stage in research	**Element 1**	**Element 2**	Element 3
Company profile Impressions is UK based business with 6 retail outlets, employing over 8 company sites approximately 120 staff. The principle business is involved in retailing ladies, men's and childrenswear clothing. All clothing items for retailing are either purchased externally 1) mainly from manufacturers to the High Street wanting to dispose of failed production or 2) from brands wanting to retail on a concession basis in the retail outlet.			

10. Company name	Nigel Cabourn http://www.cabourn.com		
Company size		**Location**	Newcastle upon Tyne
Main products	Designer menswear		
Principle product stage	Design	Manufacture	Market
Respondent role	Owner (Designer)		
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

11. Company name	Officers Club http://www.theofficersclub.co.uk		
Company size		**Location**	Cramlington
Main products	Menswear		
Principle product stage	Design	Manufacture	Market
Respondent role			Managing Director
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

12. Company name	Penny Plain http://www.pennyplain.co.uk		PENNY PLAIN
Company size		**Location**	Washington (UK)
Main products	Ladieswear		
Principle product stage	Design	Manufacture	Market
Respondent role	Designer		Merchandising Manager
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

13. Company name	Sadie the Bra Lady http://www.sadiethebralady.co.uk		Sadie
Company size	Small	**Location**	County Durham
Main products	Lingerie retailer		
Principle product stage	Design	Manufacture	**Market**
Respondent role			Owner
Stage in research	**Element 1**	Element 2	Element 3
Company profile Sadie the Bra Lady is a regional business with international customers, with 39 employees. The principle service is lingerie retail meaning that we are primarily involved in the market stage of the product lifecycle.			

14. Company name	Visage http://www.visage-group.com		VISAGE IMPORTS LTD
Company size		**Location**	South Shields
Main products	Designs garments for high street sector		
Principle product stage	Design	Manufacture	Market
Respondent role	Fashion Designer		
Stage in research	**Element 1**	Element 2	Element 3
Company profile Not provided.			

High street retail businesses

1. Company name	Littlewoods http://www.littlewoods.com		Littlewoods Shop Direct Group The UK's biggest shop @ home group
Company size		**Location**	Liverpool
Main products	Clothing across the board		
Principle product stage	Design	Manufacture	Market
Respondent role	Garment Tech		
Stage in research	Element 1	Element 2	**Element 3**

2. Company name	Marks & Spencer http://www.marksandspencer.com		YOUR M&S
Company size		**Location**	London
Main products	Clothing across the board, house wares, food		
Principle product stage	Design	Manufacture	Market
Respondent role	Garment Tech		
Stage in research	Element 1	Element 2	**Element 3**

3. Company name	Rohan http://www.rohan.co.uk		Rohan
Company size		**Location**	Milton Keynes
Main products	Outdoor wear		
Principle product stage	Design	Manufacture	Market
Respondent role	Garment Tech		
Stage in research	Element 1	Element 2	Element 3

4. Company name	Speedo http://www.speedo.co.uk		SPEEDO
Company size		**Location**	Nottingham
Main products	Swimwear & Performance swimwear		
Principle product stage	Design	Manufacture	Market
Respondent role	Garment Tech		
Stage in research	Element 1	Element 2	Element 3

5. Company name	Topshop http://www.topshop.com		TOPSHOP
Company size		**Location**	London
Main products	High street retail – young adult		
Principle product stage	Design	Manufacture	Market
Respondent role	Garment Tech		
Stage in research	Element 1	Element 2	**Element 3**

Technology providers

1. Company name	Alva Products http://www.alvaforms.com		alvaproducts
Company size		**Location**	US
Main products	Design & Prod. Dev		
Stage in research	Element 1	**Element 2**	Element 3
Company process Development of body shaped mannequins made to individual businesses' specifications. Products based on 3D scan technology and data.			

2. Company name	Blackman & White http://www.bwcutters.com		BLACKMAN & WHITE
Company size		**Location**	UK
Main products	Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process Suppliers of cutting technology/machinery to manufacturers			

3. Company name	Blue Fox Ned Graphics http://www.bluefoxta.com		BLUE FOX Porini
Company size		**Location**	Netherlands
Main products	Design & Prod. Dev, Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process Integrated apparel software solutions, fabric and garment design, product and enterprise resource solutions, CAD/CAM			

4. Company name	E-Measurement Solutions http://www.e-tape.co.uk		e-tape
Company size		**Location**	UK
Main products			
Stage in research	Element 1	**Element 2**	Element 3
Company process Electronic measurement device that is a version of a tape measure, measurements taken can be downloaded into an Excel spreadsheet via Bluetooth. Very simple device that has been adopted by many large retailers and manufacturers.			

5. Company name	GenCom http://www.gencom.be		
Company size		**Location**	Belgium
Main products	Retail, IT, Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process			

6. Company name	Gerber Technology http://www.gerbertechnology.com		GERBER TECHNOLOGY Expect More.
Company size		**Location**	Germany
Main products	Design & Prod. Dev, Retail, Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process Major supplier of technologies to the apparel sector, extensive provision of CAD and CAM hardware and software.			

7. Company name	Human Solutions GmbH http://www.human-solutions.com		HUMAN SOLUTIONS ...Focusing on the human being
Company size		**Location**	Germany
Main products	Design & Prod. Dev, Retail, Sourcing, IT		
Stage in research	Element 1	**Element 2**	Element 3
Company process Product is based around the provision and use of bodyscan technology (substantial military contracts)			

8. Company name	Infor http://www.infor.com		infor
Company size		**Location**	US
Main products	Design & Prod. Dev, Sourcing, IT, Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process PLM suppliers for the apparel sector, offers design and sales solutions (eCRM)			

9. Company name	Koppermann (Tex-Data) http://www.koppermann.com		koppermann.
Company size		**Location**	Germany
Main products	Design & Prod. Dev, Retail, IT		
Stage in research	Element 1	**Element 2**	Element 3
Company process Offers design, PDM and visual merchandising solutions			

10. Company name	Lectra http://www.lectra.com		
Company size		**Location**	France
Main products	Design & Prod. Dev, Retail, Sourcing, Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process Major supplier of technologies to the apparel sector, extensive provision of CAD and CAM hardware and software.			

11. Company name	Microsoft		
Company size		**Location**	UK
Main products	IT		
Stage in research	Element 1	Element 2	Element 3
Company process This is an offshoot of Microsoft and provides a facility to aid the retail process, few details were offered in terms of product specification.			

12. Company name	Optitex http://www.optitex.com		OptiTex Apparel | Fashion | Sewn CAD/CAM Professionals
Company size		**Location**	Isreal
Main products	Design & Prod. Dev, Retail		
Stage in research	Element 1	**Element 2**	Element 3
Company process CAD/CAM for apparel, automotive and aeronautics. Windows based software for digitizing, pattern engineering, grading and marking. Also they offer a 3D prototyping and virtual runway tool.			

13. Company name	Option Systems http://www.styleit.com		option systems STYLEman
Company size		**Location**	UK
Main products	Design & Prod. Dev, Retail, Sourcing, IT		
Stage in research	Element 1	**Element 2**	Element 3
Company process Globally accessible (internet based) IT solutions, also PDM and PRM			

14. Company name	PTC (Parametric Technology UK Ltd) http://www.ptc.com		PTC The Product Development Company
Company size		**Location**	US
Main products	Design & Prod. Dev, Retail, Sourcing, IT		
Stage in research	Element 1	**Element 2**	Element 3
Company process Developed from practices used at Boeing, offers flexible PLM for apparel, footwear and retail. Offers many services, seasonal concepts, line development, style definition, sourcing and costing.			

15. Company name	Pebblestone http://www.pebblestone.nl		pebblestone
Company size		**Location**	Netherlands
Main products	Retail, Sourcing, logistics & transport, Manufacture		
Stage in research	Element 1	**Element 2**	Element 3
Company process Based on Microsoft Dynamics NAV, a flexible system offering PLM and PDM, remote sales, inter-company connections and vendor rating.			

16. Company name	Telmat Industrie (SYMCAD) http://www.telmat-net.fr		TELMAT INDUSTRIE
Company size		**Location**	France
Main products	IT, Manufacturing technology		
Stage in research	Element 1	**Element 2**	Element 3
Company process Product is based around the provision and use of bodyscan technology (substantial military contracts)			

17. Company name	Visual Retailing http://www.visualretailing.com		visualretailing
Company size		**Location**	Dutch, UK, US
Main products	Retail, IT		
Stage in research	Element 1	**Element 2**	Element 3
Company process Takes away the need for a 'mock shop', it offers a 3D model of a store layout, allows stock levels interlinked with computerized images to be shown on spreadsheets.			

Clothing sector organisations

Organisation name	ASBCI www.asbci.co.uk	ASBCI

Profile
Formed in 1992, arising from the British Interlining Manufacturers Association, the ASBCI is a unique association in that our members represent nearly all the various sectors which are connected with the industry. From fibres to fabrics, linings, interlinings, adhesives, chemical/dye stuff suppliers, sewing threads, buttons, zips and trims, sleeve head rolls and shoulder pads, logistics, machinery, presses, waistbands, garment processors, clothing consultants, clothing manufacturers, retailers, drycleaners and launderers, domestic detergent manufacturers/chemical suppliers, computer suppliers to the clothing industry, textile testing houses, research organisations, textile universities, training bodies.

Organisation name	BCIA www.5portlandplace.org.uk	UK fashion exports BCIA Centre of the

Profile
BCIA guides and advises its members on all the essential aspects of running a business and supplying clothing and knitwear to the global marketplace. Through a membership agreement, members benefit from the services of UKFE and vice versa, the two organisations work with and support a large proportion of the industry.

Organisation name	British Fashion Council www.londonfashionweek.co.uk	BRITISH FASHION COUNCIL

Profile
Set up by industry benefactors with aim the help to promote British fashion design worldwide. Its principle activities are to raise the profile through London Fashion Week, initiatives such as New Generation, Fashion Forward and the annual British Fashion Awards.

Organisation name	Euratex http://www.euratex.org	EURATEX ONLINE

Profile
EURATEX's main objective is to promote the interests of its members while taking into account the European Union's institutional framework and its international obligations.
As the voice of the European textile and clothing industry, EURATEX's main objective is to create an environment with in the European Union which is conducive to the manufacture of textile and clothing products.

Organisation name	Industry Forum www.industryforum.net	Industry Forum

Profile
Fashion Industry Forum was formally a joint government/industry initiative to improve supply chain performance. Originally part funded by the DTI the initiative is led by the British Clothing Industry Association and key retailers and manufacturers, devised to implement best practice in the fashion supply chain from 'concept to carrier bag'.

Organisation name	Just Style www.just-style.com	

Profile
An online resource for the apparel and textile industry that provides business executives with information on current industry developments. It offers a range of reports, studies and profiles encompasses more than 40 titles, presenting a one-stop shop for research requirements. There is also a Research Store provides access to portfolios of many other leading publishers including: Datamonitor, Clothesource, Mintel and IBIS World.

Organisation name	Leapfrog http://www.leapfrog-eu.org	

Profile
Leadership for European Apparel Production From Research along Original Guidelines

Leapfrog is a joint research and innovation initiative of the European textile and clothing industry, led by Euratex, aiming at a technology breakthrough in the clothing industry. It brings together a critical mass of European textile and clothing companies and research centres which will attempt to develop and implement new ways of optimal fabric preparation for clothing production, automated garment manufacture, virtual garment prototyping, supply chain integration and mass customisation. The ultimate goal of LEAPFROG is to achieve a step change in productivity and competitiveness of Europe's clothing sector and to decrease its dependence on the labour cost factor.

Organisation name	Skillfast-UK http://www.skillfast-uk.org	

Profile
Skillfast-UK is the Sector Skills Council for apparel, footwear, textiles and related businesses.

As a Sector Skills Council, we exist to help employers to compete in a global market, by ensuring access to a skilled workforce, capable of delivering added-value products and services.

Organisation name	SDC www.sdc.org.uk	

Profile
In place 'to advance the science of colour', the Society of Dyers and Colourists aims to disseminate information through the coloration industry and beyond. This is done through the work by the members of Council, the various committees and the membership worldwide. The headquarters of the Society are based in Bradford, UK.

Organisation name	Technitex http://www.technitex.org	TechniTex

Profile
TechniTex is industrially driven and focuses on research, design and development of new technologies and applications for the textile industry.
We work with some 450 companies to bring innovation through to the market place. Our board comprises the combined strength of several university research teams together with key industrialists who epitomize the best in scientific research, training and technology.

Organisation name	Textile Institute http://www.texi.org	

Profile
The Textile Institute is a unique organisation in textiles, clothing and footwear. It was incorporated in England by a Royal Charter granted in 1925 and is a registered charity. The Institute has individual and corporate members in over 90 countries, the membership covers all sectors and all disciplines in textiles, clothing and footwear.

Within the global textiles, clothing and footwear industries the aim of the Institute is to facilitate learning, to recognise achievement , to reward excellence and to disseminate information.

Organisation name	WGSN www.wgsn.com	WGSN

Profile
WGSN is a global service providing online research, trend analysis and news to the fashion, design and style industries. It works with a network of experienced writers, photographers, researchers, analysts and trend spotters in cities around the world, tracking the latest stores, designers, brands, trends and business innovations. The company is based in London and at offices in New York, Hong Kong, Seoul, Los Angeles, Melbourne and Tokyo.

Glossary

Apparel	An alternative term for clothing.
Bodyscan data technology	This term will be adapted appropriately to refer to all uses of digital bodyscan technology, scanning, processing and data sets.
Clothing	A term used to describe wearable garments. Within this programme of research it is used as a term to describe the industry that creates garments to be sold within the retail market. It incorporates deign, manufacture and retail.
Cluster groups	A cluster is a group of industries and organisations that are linked together in buying and selling relationships, or who share the same infrastructure, customers or skills base and whose linkages enhance competitive advantage and improve efficiency (Voice-EM, 2007).
Consumer	Def[10]: Someone who buys goods and services for personal use and need.
Customer	This term will be used to refer to purchases made between businesses, i.e. retailer buying from manufacturer.
Design	Developing value through a process of organisation, resulting in an output of product, service or knowledge.
Economies of scale	Reductions in unit cost resulting from increased level of total output.
Fashion	Constant change from the creation of styled items/garments.
Information Communication Technology (ICT)	The utilisation of software, hardware technologies and services in order to communicate information.
Information Technology (IT)	Def: the use, study or production of a range of technologies (especially computer systems, digital electronics and telecommunications) to store, process and transmit information.
Innovation	Def: something new which is introduced, e.g. a new idea or method.
Intellectual Property	In law, intellectual property (IP) is an umbrella term for various legal entitlements which attach to certain names, written and recorded media, and inventions (Wikipedia, 2007a).

[10] The words listed above preceded by Def. are definitions taken from Robinson, M. & Davidson, G. W. (1996) *Chambers 21st century dictionary*. Edinburgh: Chambers.

Interrelationships	Def: to be in or be brought into a mutually dependent or reciprocal relationship.
Lite	A common marketing description for a basic, no-frills version of a product (Wikipedia, 2007b).
Mass Customisation	The production of customised goods on a on a mass production basis.
New Technologies	This term is used to refer to all technologies that can be used within the clothing industry. Throughout this paper this term will be used to describe non-bodyscan technologies.
Point cloud image	Used to illustrate data compiled using 3D laser scanners.
Process analysis tool	A mode of obtaining specific information relative to a process within a designated environment, to be developed within the thesis.
Product Data Management (PDM)	Is a form of computer software that can create automatic links between CAD systems and databases, allowing product progression to be monitored and enable generation of automatic reports to calculate costs.
Small to Medium sized Enterprise (SME)	A term used to describe businesses that have less than 250 employees, it can refer to businesses of different sizes: Micro 0-10, Small 10-50, Medium 50-250
Stakeholders	Def: someone who has an interest or a *stake* in something, especially an enterprise or business.
Value added product	Is an industrial term referring to a minor addition to some major products (Lin, Yao & Louie, 2002)

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